1972

A Comparison of Varied Reading Instructional Program as Interrelated with Modes of Learning

Paul William Cates
Loyola University Chicago

TITLE

A COMPARISON OF VARIED READING INSTRUCTIONAL PROGRAM AS INTERRELATED WITH MODES OF LEARNING

Paul William Cates

A Dissertation submitted to the Faculty of the Graduate School of Loyola University of Chicago in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 1972

LIFE

Paul William Cates was born on July 25, 1936 in Oak Park, Illinois. He attended public grammar and secondary schools receiving his diploma in 1954. He attended North Central College for undergraduate studies from 1955 to 1960 and received an M.A. degree from Northeastern Illinois University in 1969.

He taught elementary school and secondary schools. In 1967 he joined the Proviso Area for Exceptional Children in Maywood, Illinois, and directed the program for learning disabilities for the area. In 1971 he joined the faculty of DePaul University and is the Director of its Psycho-educational Clinic and Director of DePaul University graduate programs in Reading and Learning Disabilities.

ACKNOWLEDGMENTS

The author wishes to express his gratitude to Dr. Barney Berlin, Chairman of department of Curriculum and Instruction, and Mr. Carter Frieberg, and Dr. Mary Constantine, S.S.J. as advisors. He also wishes to extend deeply felt gratitude to other members of the department for generating and inspiring the ideas upon which this dissertation is based and for sharing them in such a skillful way with this student as to encourage him to put these ideas into practice. The author wishes to thank the many superintendents and principals in the Chicago area for their support and trust. The encouragement and support which came from all will be a long and warm memory. It is impossible to list all the friends, students, and colleagues who have helped in so many inexpressible ways to "give birth" to this dissertation. You know who you are and to you, a sincere thanks.

A COMPARISON OF VARIED READING INSTRUCTIONAL PROGRAMS AS INTERRELATED WITH MODES OF LEARNING

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The purpose of this study was to examine the relationship between instructional programs and modes of learning. This study researched the question, "Was there any advantage in the teaching-learning process of matching children according to their individual proclivities with a mode of instruction?"

A population of two thousand children was studied. These subjects were task analyzed on thirty three variables to categorize them as auditory, visual, or random learners. The subjects were identified as being auditory learners if they could successfully complete ninety per cent of all auditory tasks required of them. They were identified as visual learners if they could successfully complete ninety per cent of all visual tasks required of them. They were identified as being random learners if they could successfully complete ninety per cent of both auditory and visual tasks asked of them.

After the task analysis a sample of five hundred and forty subjects were accepted. Then a further screening was done to control for high intelligence and low intelligence. This left a sample of one hundred and forty four subjects. The sample was divided into twelve cells. The cells had, as their first criterion, mode of learning: that is, auditory, visual, or random. The second criterion was intelligence quotient, that is, a high intelligence quotient (over one hundred and ten) as measured by the Lorge-Thorndike Primary Battery - Level I; or low intelligence quotient, that is below ninety. The third criterion was the classroom method to which the learner was to be exposed for nine months while attending a first grade classroom. Two methods were used in this study: the Initial Teaching Alphabet because of its heavy audi-

tory stresses and the Ginn 360 Basal series because of its heavy visual stresses.

The data analyzed from the Metropolitan Achievement Test-reading subtest revealed that there is a significant relationship between mode of learning and method of classroom instruction. The relationship is significant at the .01 level between individual proclivities (auditory and visual) and appropriate mode of instruction. This is an inverse relationship and showed that the significance is in matching auditory proclivity with a visual method and visual proclivity with an auditory method. The conclusion made from this was that the important criterion to be met by the subject in learning to read was not just the proclivity through which he learns but the subject's exposure to a method that integrates his mode of learning, reinforcing it while remediating his weaker area. The data also proved that reading achievement is not related to the instructional program used to teach reading. The two programs analyzed in this study, that is, Initial Teaching Alphabet and Ginn 360 Basal Series were not the important factor. The integrative ability of the method to teach to the learner's weakness yet reinforce the learner's strength appears to be the important variable.

The influence of intelligence on reading achievement was also verified. The mean reading achievement score for students of high intelligence was 2.59. The mean reading achievement score for students of low intelligence was 1.81. The influence of intelligence as a variable was significant beyond the .001 level as measured by the Metropolitan Achievement Test-reading subtest. The research concluded that reading achievement is affected by auditory and visual associations and the ability of the subjects to integrate the auditory and visual modalities.

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CHAPTER I

INTRODUCTION

In reminding us of the challenge of the future, author Ruth Tooze[1] points out the desirability of a literate society wherein communication is open in all directions: to the past, in the present, to the future. Only in such a society are the ideas and values available able to contribute to the optimum development of individuals. Education can play a vital role in the growth and development of the citizenry provided that the process of education comes to grips with the individual needs of students.

The purpose of this dissertation is to examine the relationship between instructional programs and modes of learning, using group and individual screening and teacher observations. Children were identified as being auditory or visual learners. They were designated as being auditory learners if they could successfully complete ninety per cent of all auditory tasks asked of them. They were identified as visual learners if they could successfully complete ninety per cent of all visual tasks required of them.

Since there are a number of primary children who are unable to achieve their learning expectancy level by being able to perform to the capacity

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[1]Ruth Tooze, "The 1965 Thinking Student--The 1985 Thoughtful Citizen," Reading and Thinking. Proceedings of the 22nd Annual Reading Institute at Temple University, 1965 (Philadelphia: Temple University, 1965), pp. 78-81.

that their readiness tests indicate, it should be a practical contribution to the efficiency of the education of children if particular reading programs could be identified as being a better vehicle for one learning proclivity than another. Likewise, it would be useful, if proven, that teaching to a child's proclivity increases his reading achievement. Using the knowledge presently available about visual and auditory modes of learning, is there any practical pedagogical advantage to the efficiency of the teaching-learning process to match children according to their individual proclivities with the appropriate mode of instruction?

We thus arrive at the following null hypotheses:

1. There is no practical pedagogical advantage to the efficiency of the teaching-learning process to match children according to their individual proclivities (auditory or visual) with the appropriate mode of instruction.
2. Students whose learning styles are either auditory or visual will read at the same level in a given environment.
3. First grade reading achievement is not related to the instructional program, that is the Initial Teaching Alphabet or the Ginn 360 Basal Series used to teach reading.
4. First grade reading achievement is not related to intelligence, as measured by instruments utilized in this dissertation.

5. Modality development, auditory, visual, or random, does not predict reading success.
6. Standardized reading readiness tests do not predict reading success.

CHAPTER II

REVIEW OF RELATED RESEARCH - PART I

Perceptual Modes of Learning

It is commonly acknowledged that in our society children need to learn to read effectively. There are some children who do not learn to read effectively. A perennial enigma of the primary teacher is the under-achiever. A child who is assessed to have at least minimal learning capacity fails to achieve academic success commensurate with his abilities. Researchers and educators in the past have sought to ameliorate the problem learner's plight by concentrating on instructional materials, teaching techniques and administrative organizational structures. While all these may be relevant to the teaching-learning process, very little attention has been directed to the relation between the learner's perception of the learning task and academic success.

This is not to say that percept has been totally neglected. Huey,[2] in his conspectus published in 1908, presented some interesting observations based on his research and the work of Zeither, Messmer and others. Huey defined perceiving as an active process, not

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[2]Edmund Burke Huey, The Psychology and Pedagogy of Reading: With a Review of the History of Reading and Writing and of Methods, Texts, and Hygiene in Reading (Cambridge, Massachusetts: MIT Press, 1968, originally published in 1908 by the Macmillan Company), pp. 104-109.

as a "mere passive sensing of a group of passing sensations or impressions." He reasoned further that if perceiving was an act, then, like all other actions, it could be performed more easily and more effectively with repetition. Huey suggested that research appeared to show

> ...that the first factors of perception are not usually the total form, word-length, etc., but certain striking 'dominant' parts, the appreciation of total word-form and word-length coming a little later as the recognition is completed at the suggestion of these dominant cues.

In the years since Huey there have been other prominent researchers (Witty and Kopel, Betts and Austin, Poling and Goins)[3] who have explored the relationships between auditory and visual skills and reading disabilities. Growing out of these studies has been an interest in investigating children's predilections.

Recent research has established the validity of the construct of mode of learning, i.e., perceptual proclivities affect cognition. Gould has drawn the relationship between mode of learning and cognition quite

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[3]Paul A. Witty and D. Kopel, "Factors Associated With the Etiology of Reading Disability," Journal of Educational Psychology, 27:119-134, 1936; Emmett A. Betts and A. S. Austin, Visual Problems of School Children (Chicago: Professional Press, 1941); D. L. Poling, "Auditory Deficiencies of Poor Readers," Supplementary Educational Monograph, Proceedings of the Annual Conference on Reading, University of Chicago, vol. 77 (Chicago: University of Chicago Press, 1953) pp. 107-111; Jean T. Goins, "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monograph, Proceedings of the Annual Conference on Reading, University of Chicago, vol. 87 (Chicago: University of Chicago Press, 1958), pp. 1-108.

succinctly in a recent article on visual perception:

> The child is made aware of the environment by the sensory mechanisms of his body. The sensory mechanisms bring information about the internal and the external environment to the child....
> Learning, in its general sense, then, has as a prequisite the ability to perceive differences and changes in the environment. Cognitive development depends on sensori-motor achievements, which in turn depend on the child's perceptual abilities and his capacities to respond. These perceptual abilities are measured in terms of discrimination between various stimuli, for example, auditory and visual.[4]

The rationale of the modes of learning construct includes the following concepts:

1. Awareness of the environment comes through the body's senses.
2. Functioning of the senses at any one time is dependent upon the rate of development and maturity of each of the senses, individually and integratively.
3. The level of acuity, perception and integration of a particular sense affects the effective function of that sense.
4. Children differ in their degree of perceptual development and their mode of learning.
5. The emergence rate of development and maturity of the senses (at least visual and auditory appears to stop or slow down drastically by approximately age eight.[5]

Studies dealing with auditory and visual perception have been much

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[4]Lawrence N. Gould, "Visual Perception Training," Elementary School Journal, (April, 1967), p. 381.

[5]Joseph M. Wepman, "Auditory Discrimination, Speech and Reading, Visual Abilities in Perceptual-Motor Learning." Journal of Experimental Psychology, (vol. 66, 1963), p. 6.

more frequent than those of tactile-kinesthetic.[6] Accordingly, this study will deal exclusively with audition and vision propensities and how they bear upon learning to read in grade one.

Research has provided a workable assessment of children's predominant perceptual modes using group screening instruments.[7] It now remains for classroom teachers to explore with the implications of the modes of learning theory.

At this time in the field of education there exists no universally accepted theory of learning. Various psychologists and educators have provided narrow hypotheses for this or that facet of the learning process. Perhaps the most that can be said unequivocally (in agreement with Kephart)[8] is that learning is a dynamic process. Wepman suggests:

> that major differences do exist in children at the perceptual level of learning which may materially affect their learning; that these differences are fundamental to learning; that they underlie the conceptual level and provide the basic precepts upon which concepts are built; and that they must be understood and clarified before the conceptual level is focused upon.[9]

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[6]Edwin A. Fleishman and Simon Rich, "Role of Kinesthetic and Spatial-Visual Abilities in Perceptual-Motor Learning." Journal of Experimental Psychology (vol. 66, 1963), p. 6.

[7]Joseph M. Wepman, "The Perceptual Basis for Learning." Meeting Individual Differences in Reading, Proceedings of the Annual Conference on Reading Held at the University of Chicago, 1964 (Chicago: University of Chicago Press, 1964), pp. 31-32.

[8]Newell C. Kephart, The Slow Learner in the Classroom (Columbus, Ohio: Charles E. Merrill Books, Inc., 1960), pp. 66-67.

[9]Wepman, op. cit., p. 25.

More specifically to the area of reading. Budoff and Quinlan assert that "The process of learning to read depends largely on perceptual skill."[10]

Perceptual skills include, among others, visual, auditory, tactile-kinesthetic. As was stated above, most of the research on the relation between perceptual skills and learning to read has been limited to visual and auditory perceptions. The particular relations, between reading and visual perception and between reading and auditory perception, have been well documented.

Gould has related mode of learning to cognition quite succinctly in a recent article:

> The child is made aware of the environment by the sensory mechanisms of his body. The sensory mechanisms bring information about the internal and external environment to the child...
>
> Learning, in its general sense, then, has as a prerequisite the ability to perceive differences and changes in the environment. Cognitive development depends on sensori-motor achievements, which in turn depend on the child's perceptual abilities and his capacities to respond. These perceptual abilities are measured in terms of discrimination between various stimuli, for example, auditory and visual.[11]

Though this dissertation deals primarily with perception as related

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[10]Milton Budoff and Donald Quinlan, "Reading Progress as Related to Efficiency of Visual and Aural Learning in the Primary Grades," Journal of Educational Psychology, (vol. 55, 1964), p. 247.

[11]Lawrence N. Gould, "Visual Perception Training." Elementary School Journal, p. 381, April, 1967.

to success in reading, it is important to note the place of perception in the total learning process. This relationship has been alluded to in several of the above studies and will merely be summarized here. The learning process is conceived as hierarchial (in structure and in process beginning with acuity (discrimination), perception, integration, conception. In addition to Wepman's discussion of this concept,[12] there is Bartley's[13] text and Gould's[14] description). These authors have provided significant information about the place of perception in the total learning process. The above studies provide convincing support for the idea that learning is perceptually based.

In the area of auditory perception and reading there is, for example, Durrell and Murphy's statement:

> Although there are many factors which combine to determine a child's success in learning to read, it is apparent that his ability to notice the separate sounds in spoken words is a highly important one.[15]

The relationship between reading achievement and auditory abilities is

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[12]Wepman, op. cit., pp. 25-26.

[13]Howard Bartley, Principles of Perception (New York: Harper and Brothers, 1958), p. 40.

[14]Gould, op. cit., p. 382.

[15]Donald D. Durrell and Helen A. Murphy, "The Auditory Discrimination Factor in Reading Readiness and Reading Disability," Education, 73:560, May, 1953.

minutely delineated in Wepman's often referred to article in the Elementary School Journal.[16] In a more recent research report, Morency[17] provides a preliminary presentation of results of a longitudinal study relating auditory discrimination and auditory memory to achievement in the first three grades in school.

The evidence to substantiate the relationship between vision and reading is not clear cut. Chall[18] reviews the research and clearly identifies a conflict of conclusions regarding the relationship between vision and reading achievement. Harris concludes that the weight of evidence substantiates the dependence of reading achievement upon visual abilities. Ilg and Ames[19] make an important distinction between a visual problem and an eye problem. In this dissertation we are dealing with the former (visual perception) rather than the latter (visual acuity). While earlier research dealt primarily with aspects of visual acuity, more recent articles are clarifying the distinction between perception and acuity

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[16]Joseph M. Wepman, "Auditory Discrimination, Speech and Reading." Elementary School Journal, p. 325, March 1960.

[17]Anne Morency, "Auditory Modality--Research and Practice," Perception and Reading. Proceedings of the 12th Annual Convention of the International Reading Association, vol. 12, part 4 (Newark, Delaware: International Reading Association, 1968), pp. 18-19.

[18]Chall, J. S. Learning to Read: The Great Debate, New York: McGraw-Hill, 1967.

[19]Frances L. Ilg and Louise Bates Ames, Child Behavior (New York: Harper and Row, 1955), pp. 293-295.

and drawing attention to the importance of visual perception to reading achievement.

"...The suditory ability is not assured by a high mental age or by elaborate exercises in 'phonics' which consist in giving sounds of letters and blends."[20] Based on his research, Wepman[21] concludes similarly that there is little, if any, relationship between auditory discrimination and intelligence. It should be noted that there is conflicting evidence on this point. Thompson concluded, "From the statistical analysis of the data of this study, it would appear that auditory discrimination and intelligence are highly correlated with success in primary reading."[22]

Though it may not be necessary to spell out the delineation between auditory and visual perception there has been at least one piece of research conducted in which the results would suggest that the two perceptions are not substantially related.[23] This conclusion is supported by Morency[24] when she makes the observation that a child's improvement in one

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[20]Durrell and Murphy, op. cit., p. 556.

[21]Joseph M. Wepman, "Auditory Discrimination, Speech and Reading." Elementary School Journal; p. 326, March, 1960.

[22]Bertha Boya Thompson, "The Relation of Auditory Discrimination and Intelligence Test Scores to Success in Primary Reading," Unpublished doctoral dissertation, Indiana University, 1961, p. 121.

[23]Norman A. Buktenica, "Relative Contributions of Auditory and Visual Perception to First-Grade Language Learning." Unpublished doctoral dissertation, University of Chicago, 1966.

[24]Morency, op. cit.

modality may or may not be reflected by improvement in the other, (auditory or visual).

Thus far the review of the literature has been presented to suggest that research has established the validity of the construct of mode of learning. Now let us determine if results of research would support the contention that predilections are learned and can be ameliorated with training.

McNeil and Coleman[25] hypothesized that children who are taught to hear and discriminate spoken words will achieve greater success in learning to analyze printed words. Their research supported their hypothesis. Resnick[26] conducted an investigation of the effects of perceptual training and socia-economic class upon visual integrative ability. Among other things he concluded that perceptual integrative abilities can be accelerated with training. Cleland[27] sought to devise procedures for improving auditory and visual perception and thereby, hopefully, to improve word perception. Based on the results of his efforts, Cleland concluded that

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[25]John D. McNeil and James C. Coleman, "Auditory Discrimination Training in the Development of Word Analysis Skills," ERIC #ED 018 344 (Sept., 1968, vol. 3 #9).

[26]Robert J. Resnick, "An Investigation of the Modifiability of Visual Integrative Abilities in Children," ERIC #ED 017 009 (Aug., 1968, vol. 3 #8).

[27]Donald L. Cleland, "Improving Word Perception," ERIC #ED 014 405 (April, 1968, vol. 3 #4).

these skills were amenable to training.

In summary, then, we have the following conclusions and deductions. Together they form the rationale for the concept of mode of learning.

1. Awareness of the environment comes through the body's senses.
2. Learning is perceptually based.
3. Functioning of the senses at any one time is dependent upon the rate of development and maturity of each of the senses, individually and integratively.
4. The level of acuity, perception and integration of a particular sense affects the effective function of that sense.
5. Children differ in their degree of perceptual maturation and development and their mode of learning.
6. The emergence rate of development and maturity of the senses (at least visual and auditory) appears to stop or slow down drastically by approximately age nine.
7. Modalities in which learning will take place are chosen by the individual.[28]

The idea of adjusting instruction to the child's mode of learning has been suggested by several writers, i.e., Anderson and Dearborn,[29]

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[28]Joseph M. Wepman, "The Modality Concept--Including a Statement of the Perceptual and Conceptual Levels of Learning," Perception and Reading, Proceedings of the 12th Annual Convention of the International Reading Association, vol. 12 part 4 (Newark, Delaware: International Reading Association, 1968), p. 3.

[29]Irving H. Anderson and Walter F. Dearborn, The Psychology of Teaching Reading (New York: The Ronald Press Company, 1952), p. 138:

MacGinitie,[30] Smith and Dechant,[31] and Wepman.[32] This dissertation is an implementation of adjusting teaching method to learning modality.

In summary, among the several critical factors influencing the learning process are perceptual abilities. There appears to be pedagogical justification for adjusting the teaching approach to the child's learning modality.

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[30]Walter H. MacGinitie, "Auditory Perception in Reading," Education, p. 533, May, 1967.

[31]Henry P. Smith and Emerald V. Dechant, Psychology in Teaching Reading (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961), p. 138.

[32]Joseph M. Wepman, "The Perceptual Basis for Learning," Meeting Individual Differences in Reading. Proceedings of the Annual Conference on Reading Held at the University of Chicago, 1964 (Chicago: University of Chicago Press, 1964), p. 27.

Perceptual Influences in the Primary Grades

In a review of selected research, the perceptual skills of vision and audition are here discussed in terms of their relations and as each influences the acquisition of academic skills, especially that of reading. The possibility of a modality concept in which children have differential learning strengths at the perceptual level is considered. Such a concept, if valid, could lead to the teaching of early academic skills through differential procedures emphasizing the identified perceptual strengths.

Innumerable books and articles have been written about the prototype of academic success; competent reading and the factors contributing to success in related skills.

The dynamics of the reading process are being subjected to closer observation and more critical analysis by researchers such as Gibson[33] but many questions remain to be answered concerning the critical elements which distinguish the successful reader from his otherwise normal but struggling peer.

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[33]Gibson, E. J., "Experimental Psychology of Learning to Read," In J. Money (Ed.), The Disabled Reader, Baltimore: Johns Hopkins, 1966, pp. 41-58.

This dissertation discusses differences in perceptual abilities, particularly as such differences affect the learning of reading and related skills in grade one. A multitude of factors interact to determine success in school; reading and related academic abilities are extremely complex functions. Consequently, perceptual influences should be related to other considerations, such as general intelligence and early experiences. Research and teacher reports, however, contend that perceptual skills are of particular importance in the early grades. Anderson White, Bashaw, & Olson[34] indicated that teachers rated vision and hearing close behind such factors as mental age, background, and desire to read in importance among "reading readiness" factors. Budoff & Quinlan[35] reported that learning to read probably depends mainly on perceptual factors.

It is generally agreed that perceptual abilities follow a developmental or maturational pattern: they normally become more efficient as the child gets older. A passive view of maturation is questionable

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[34]Anderson, H. E., White, W. F. Bashaw, W. L. and Olson, A. V., "Relative Importance of Reading Readiness Factors as Perceived by Various Teacher Groups," Perceptual and Motor Skills, 1967, 24, 899-902

[35]Budoff, M. and Quinlan, D. "Reading Progress as Related to Efficiency of Visual and Aural Learning in the Primary Grades." Journal of Educational Psychology, 1964, 55, 247-252.

according to such authorities as Lynn[36]. Numerous authorities discuss many of the expected maturational changes in perception; (e.g., Buktenica, Gates, Gibson, Gibson, Pick, and Osser, and Wepman[37]).

Piaget suggested that perceptual and sensorimotor experiences lay the foundations for later symbolic and conceptual processes.[38] Wepman[39] formulated a three stage hierarchical model of language and thought processes of which perceptual abilities are an integral part. Wepman[40] suggested

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[36]Lynn, R., "Reading Readiness and the Perceptual Abilities of Young Children," Educational Research, 1963, 6, 10-15.

[37]Buktenica, N. A. Visual Learning, San Rafael, Calif.: Dimensions Publishing Co., 1968; Gates, A. T., "Implications of the Psychology of Perception for Word Study," Education, 1955, 75, 589-595; Gibson, E. J., Gibson, J. J., Pick, A. D., and Osser, H., "A Developmental Study of the Discrimination of Letter-like Forms," Journal of Comparative and Physiological Psychology, 1962, 55, 897-906; Wepman, J. M., "The Perceptual Basis for Learning," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 25-33.

[38]Flavell, J. H. The Developmental Psychology of Jean Piaget, New York: Van Nostrand, 1963.

[39]Wepman, J. M., "Auditory-Discrimination Speech and Reading," Elementary School Journal, 1960, 60, 325-333.

[40]Wepman, J. M., "The Perceptual Basis for Learning," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 25-33.

that conceptual functioning is built on perceptual experiences.

Barrett[41] in his studies of visual perception suggested that most studies have found positive relations between pre-reading visual discrimination and subsequent reading performance. Barrett[42] also found that skills in word matching, reading letters and numbers, and pattern copying were the best combination of visual discrimination forecasters of first grade reading. Nila[43] concluded that visual discrimination performance was second only to auditory abilities in its influence on learning to read. Goins[44] and Ryan[45] showed that visual perceptual skills had significant predictive value for reading achievement at

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[41]Barrett, T. C., "The Relationship Between Measures of Pre-Reading Visual Discrimination and First Grade Reading Achievement: A Review of the Literature," Reading Research Quarterly, 1965, T, 51-75.

[42]Barrett, T. C., "Visual Discrimination-Tasks as Predicators of First Grade Reading Achievement," The Reading Teacher, 1965, 18, 276-282.

[43]Nila, Sister M., "Foundations of a Successful Reading Program," Education, 1953, 73, 543-555.

[44]Goins, J. T., "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs, No. 37, University of Chicago Press, 1958.

[45]Ryan, Q. R., "Relative Importance of Intelligence and Visual Perception in Predicting Reading Achievement," California Journal of Experimental Education, 1939, 8, 208-244.

beginning levels. On the other hand, Rizzo[46] and Johnson[47] were unable to find support for a relation between visual perceptual functioning and reading achievement.

Few studies have dealt with both auditory and visual skills. Katz and Deutsch[48] successfully differentiated between good and poor readers on the basis of most of the visual and auditory tests they used. Differentiation was especially good during the early grades. Lockhart and Sidowski[49] and Van Mondfrans and Travers[50] had also found superior learning

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[46]Rizzo, N. D., "Studies in Visual and Auditory Memory Span with Special Reference to Reading Disability," Journal of Experimental Education, 1939, 8, 208-244.

[47]Johnson, M. S., "Factors Related to Disability in Reading," Journal of Experimental Education, 1957, 26, 1-26.

[48]Katz, P. A., and Deutsch, M. Visual and Auditory Efficiency and Its Relationship to Reading in Children, Final Report, Project No. 1099, Cooperative Research Program, Washington: Office of Education, Department of Health, Education and Welfare, 1963.

[49]Lockhart, J. and Sidowski, J. G., "Learning in Fourth and Sixth Graders as a Function of Sensory Mode of Stimulus Presentation, and Overt or Covert Practice," Journal of Educational Psychology, 1961, 52, 262-265.

[50]Van Mondfrans, A. P. and Travers, R. M. W., "Paired Associate Learning Within and Across Sense Modalities and Involving Simultaneous and Sequential Presentations," American Educational Research Journal, 1965 2, 89-99.

via the visual modality in two learning experiments. DeHirsch, Jansky, and Langford[51] included tests of visual and auditory abilities in their final "Predictive Index" of pre-school children who have a high prognosis for reading problems.

Buktenica[52] predicted end of first grade reading achievement on the basis of visual and auditory test performances. He found that scores on the two types of tests were practically independent with verbal components held constant. Auditory and visual scores each predicted achievement, although the variance accounted for was substantially increased when both modalities were included in the multiple correlation. A three year follow-up found first grade perceptual scores still predicting end of third grade achievement at levels comparable to the first grade correlations.[53]

A major portion of reading involves integration of information from more than one modality in the translation of an auditory-temporal pattern into a visual-spatial one. Wepman[54] suggested that without the

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[51]DeHirsch, K. Jansky, J. J., and Langford W. S. Predicting Reading Failure, New York: Harper and Row, 1966.

[52]Buktenica, N. A., "Perceptual Mode Dominance: An Approach to Assessment of First Grade Reading and Spelling," Paper presented to American Psychological Associaton, San Francisco, September, 1968.

[53]Buktenica, N. A., "Auditory and Visual Perception as Predictors of Reading Achievement Through Third Grade: An Interim Report," Paper presented to Tennessee Psychological Association, Chattanooga, October 1968.

[54]Wepman, J. M., "Auditory Discrimination, Speech, and Reading," Elementary School Journal, 1960, 60, pp. 325-333.

ability to shift to other modal learning, little integrative meaning could be attached to the printed or spoken word. Wepman, Jones, Bock, and Van Pelt[55] suggested that integration abilities are important in language. While receptive and expressive functions appear to be modality-bound, integrative functions mediate between these sensory processes and are essential to competent language behavior and conceptual thought development.

Several studies have investigated auditory-visual integration as it related to reading. Birch and Belmont[56] found rapid growth in visual-auditory equivalence occurring from kindergarten through the second grade. Auditory-visual integration scores correlated significantly with reading for the younger children, and retarded readers were substantially lower in their integration skills than their normal counterparts. This was supported by Muehl and Kremenak's[57] findings that these integration skills

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[55]Wepman, J. M., Jones, L. V., Bock, R. D. and Van Pelt, D., "Studies to Aphasia: Background and Theoretical Formulations." Journal of Speech and Hearing Disorders, 1960, 25, 323-332.

[56]Birch, H. G. Belmont, L., "Auditory-Visual Integration in Normal and Retarded Readers." American Journal of Ortho-psychiatry, 1964, 34, 852-861.

[57]Muehl and Kremensk, S, "Ability to Match Information Within and Between Auditory and Visual Sense Modalities and Subsequent Reading Achievement." Journal of Educational Psychology, 1966, 57, 230-238.

were highly predictive of reading levels at the extremes in reading ability.

Sterritt and Rudnick[58] were unable to repeat Birch and Belmont's findings. They proposed that the critical factor in predicting reading may be auditory pattern perception per se, rather than the ability to transpose from auditory to visual stimuli. Ford[59] raised similar questions when he found that with IQ held constant, auditory-visual scores showed little additional correlation with reading.

Other integration studies have dealt with visual-motor functioning. That this kind of functional integration is related to acquisition of academic skills is supported by many (e.g., Beery, DeHirsch, Keogh, Koppitz, and Barrett.[60]

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[58]Sterritt, G. M., and Rudnick, M., "Auditory and Visual Rhythm Perception in Relation to Reading Abilities in Fourth Grade Boys." Perceptual and Motor Skills, 1966, 23, 859-864.

[59]Ford, M. P., "Auditory Visual and Tactual Visual Integration in Relation to Reading Ability," Perceptual and Motor Skills, 1967, 24, 831-841.

[60]Beery, K. E. Visual-Motor Integration, Chicago: Follett, 1967; DeHirsch, K., "Tests Designed to Discover Potential Reading Difficulties at the Six-year Old Level," American Journal of Orthopsychiatry, 1957, 27, 566-576: Keogh, B. K., "Form Copying Tests for Prediction of First Grade Reading," 27th Yearbook, Claremont Reading Conference 1963, 141-144; Koppitz, E., The Bender Gestalt Test for Young Children, New York: Grune and Stratton, 1964; Barrett, T. C., "The Relationship Between Measures of Pre-reading Visual Discrimination and First Grade Reading Achievement: A Review of the Literature," Reading Research Quarterly, 1965, I, 51-75.

This review has clarified the proposition that perceptual abilities are of considerable importance during the primary grades. The question of how such influences could most effectively be dealt with now arises.

American education emphasizes the realization of each child's potential. The field of education is based in part on the belief that individual differences in learning styles and abilities exist and that they require procedures designed to fit each child. The need for remedial programs is not questioned, but there may be alternatives. Current educational and psychological theory concerning the treatment of learning seems to be shifting from remedial orientation toward a more preventive model. In education, it functions to analyze the antecedents and critical components of learning. With more emphasis on early educational experiences, and the corresponding feeling that maturation does not solve all problems, it becomes increasingly important to assess learning characteristics so that potential problems may be identified and real problems may be prevented.

Also it might be useful to assess a child's strengths. By focusing on learning strengths and proclivities, one could promote a better educational description of the child. This dissertation will now consider possible perceptual abilities which, if validly differentiated, could lead to a more precise description of learning characteristics for many children and later to the utilization of the appropriate teaching procedures.

A Modality Concept

In a discussion of Charcot's views on aphasia, Freud,[61] indicated that the idea of dominant or preferred perceptual systems is not new. Charcot had suggested some one hundred years ago that individuals differ in their reliance upon given perceptual modalities for the behaviors of reading, writing, and speaking: some rely primarily upon visual impressions, others upon auditory, and still others upon kinesthetic associations. The existence of a special strength for receiving and interpreting stimuli through a particular pathway could be inferred from such modality preferences.

When thought processes were popularly felt to include "mental imagery" of some sort, Galton,[62] did research on the prevalence of visual imagery. He found that some people did possess exceptional visual imagery systems, attending to the visual equivalent rather than to the sound of spoken words. Such a proclivity was not necessarily connected with keen sight or a tendency to dream.

Binet,[63] discussed differences in imagery systems. Crediting

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[61] Freud, S., On Aphasia: A Critical Study, New York: International Universities Press, 1953.

[62] Galton, F. Inquiries Into Human Faculty and Its Development, London: J. M. Dent and Co., 1883.

[63] Binet, A., The Psychology of Reasoning, Chicago: Follett, 1967.

Charcot, Binet suggested a natural inequality in the different forms of imagery used in memory and thought. He delineated four "types" of persons, adding the "indifferent" type, who supposedly had facility with all kinds of images, to Charcot's trichotomy of "visual", "auditory", and "kinesthetic".

The idea of specialized proclivities for learning in the different modalities is still viable. Wepman[64] suggested that differences in the critical factors related to reading do exist at the perceptual level. He indicated that the modality concept is most concerned with prelinquistic skills which provide the foundation for integrative and comprehension abilities. Wepman stated that:

> individual differences in perceptual transmission and conceptual learning can be demonstrated to be along modality lines; methods for teachers or the school system to determine a given child's maximal learning modality, if they are inclined to do so, remain to be discovered[65]

Others (e.g. DeHirsch et al,[66] Harris[67]) have reported evidence suggesting the possibility of dominant learning modalities and have

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[64] Wepman, J. M., "The Perceptual Basis for Learning," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 25-33.

[65] Ibid. pp. 25-33.

[66] DeHirsch K., Jansky, J. J., and Langford, W. S., Predicting Reading Failure. New York: Harper and Row, 1966.

[67] Harris, A. J., "Influences of Individual Differences on the Reading Program." In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 17-24.

indicated that such perceptual styles should be taken advantage of by using instructional methods adapted to the child's particular strengths in perception imagery, and recall. Deutsch and Zawel[68] also found that modality-specific injuries in brain injured children resulted in greater homogeneity of functioning and modality-related patterns of response and ability.

The finding by Buktenica,[69] that functioning in the auditory and visual modalities is largely independent, supports the possibility of preferred modalities of learning. Similarly, Wepman[70] suggested an independence of abilities in these two modalities. This may also explain in part why Dykstra[71] and Rizzo[72] could not adequately predict reading achievement solely on the basis of perceptual tests tapping only one modality.

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[68]Deutsch, C. P., and Zawel, D., "Comparison of Visual and Auditory Perceptual Functions of Brain-injured and Normal Children," Perceptual and Motor Skills, 1966, 22, 303-309.

[69]Buktenica, N. A., "Perceptual Mode Dominance: An Approach to Assessment of First Grade Reading and Spelling." Paper presented to American Psychological Association, San Francisco, September 1968.

[70]Wepman, J. M., "The Perceptual Basis for Learning," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 25-33.

[71]Dykstra, R., "Auditory Discrimination Abilities and Beginning Reading Achievement," Reading Research Quarterly, 1966, I, 5-34.

[72]Rizzo, N. D., "Studies in Visual and Auditory Memory Span with Special Reference to Reading Disability," Journal of Experimental Education, 1939, 8, 208-244.

If such differences do, in fact, exist on a population wide basis, this model could find classroom application in the form of differential teaching procedures. Too often a school adopts one approach, hoping that it will benefit all children. Unfortunately, the benefits of such an impersonal application are generally scanty. Wepman[73] indicated that when a strength is noticed teaching should be through this preference with additional training in the weakness. He called for child-centered, not method-centered, teaching. Harris[74] added that, "Possibly these one-method enthusiasts are themselves strong in just one modality of imagery and assume that everyone else must be like them.[75] Similarly, DeHirsch et al.[76] indicated "that exploration of modality strength and weakness is

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[73]Wepman, J. M., "The Perceptual Basis for Learning," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago:

[74]Harris, A. J., "Influences of Individual Differences on the Reading Program," In H. A. Robinson (Ed.), Meeting Individual Differences in Reading, Chicago: University of Chicago Press, 1964, Pp. 17-24.

[75]Ibid. p. 20.

[76]DeHirsch, K. Jansky, J. J., and Langford, W. S. Predicting Reading Failure, New York: Harper and Row, 1966.

of more than theoretical interest and should largely determine teaching methods"[77], and that one method of teaching must no longer be favored over another as a matter of principle.

Buktenica[78] also discussed the possibilities for early assessment and subsequent differential teaching through modality preferences. Early assessment can assist in providing a description of normal learning attributes. Knowing the assessments for individual children, teachers can provide each child with the experiences which will profit him most.

To date, the practical application of such an approach has not been sufficiently attempted. Bateman[79] Bruininks[80] and Harris[81] have

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[77]DeHirsch, K., Jansky, J. J., and Langford, W. S. Predicting Reading Failure, New York: Harper and Row, 1966, p. 82.

[78]Buktenica, N. A. Visual Learning, San Rafael, Calif.: Dimensions Publishing Co., 1968.

[79]Bateman, B., "The Efficacy of an Auditory and a Visual Method of First Grade Reading Instruction with Auditory and Visual Learners," Curriculum Bulletin (School of Education, University of Oregon), 1967, 23, 6-14.

[80]Bruininks, R. H., "Relationship of Auditory and Visual Perceptual Strengths to Methods of Teaching Word Recognition Among Disadvantaged Negro Boys." Unpublished doctoral Dissertation. George Peabody College for Teachers, Nashville, Tenn, 1968.

[81]Harris, A. J., "Individualizing First Grade Reading According to Specific Learning Aptitudes," Research report, Office of Research and Evaluation, Division of Teacher Education of the City University of New York, April 1965, p. 12.

all explored how hypothesized perceptual strengths should influence learning abilities. Bateman[82] and Harris[83] did their studies in classroom settings. First graders, previously rated by Harris as having either auditory or kinesthetic preferences, were given supplementary individualized instruction in one of these two modes. The children did not respond as predicted by their purported special abilities. Bateman on the basis of Illinois Test of Psycholinguistic Abilities (McCarthy and Kirk[84]) scores, defined first graders as auditory or visual, but found that an auditory approach to reading was superior in terms of first grade reading achievement and spelling scores, regardless of perceptual preference.

Several methodological limitations may have affected these studies, especially in regards to basis for differentation as "type" of learner and to loose controls for the style or method of teaching used. The

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[82]Bateman, B., "The Efficacy of an Auditory and a Visual Method of First Grade Reading Instruction with Auditory and Visual Learners," Curriculum Bulletin (school of Education, University of Oregon), 1967, 23, 6-14.

[83]Harris, A. J., "Individualizing First Grade Reading According to Specific Learning Aptitudes," Research report, Office of Research and Evaluation, Division of Teacher Education of the City University of New York, April 1965, p. 12.

[84]McCarthy, J. J. and Kirk, S. A., The Illinois Test of Psycholinguistic Abilities Examiner's Manual, Urbana, Ill.: University of Illinois Press, 1961.

relevance of these studies is not questioned, but an intermediate step, which would precede class-wide investigations and allow better controls for the variables of identification of preferences and administration of procedures, seems to be necessary. More adequate standardization of the methodology of the design would also enable a clearer interaction of the critical variables and would earn more definite conclusions.

Bruininks[85] was also unable to find any hypothesized interaction between modality of presentation and perceptual strengths in ability to learn a list of unknown words. His study had adequate controls in the area of presentation of materials, but his use of third graders may have been the variable that affected the results.

Bateman[86] debated the yet unanswered question of whether to orient remedial assistance toward the strength or the weakness. Emphasis on deficient areas is another phenomenon of the medical model and is the advocated approach of many programs of perceptual training (e.g. Frostig and Horne,[87] McCarthy and Kirk[88]). The implications of this

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[85]Bruininks, R. H., "Relationship of Auditory and Visual Perception Strengths to Methods of Teaching Word Recognition Among Disadvantaged Negro Boys," Unpublished doctoral dissertation. George Peabody College for Teachers, 1968.

[86]Bateman, B., "Learning Disorders," Review of Educational Research, 1966, 36, 93-119.

[87]Frostig, M and Horne, D. Teacher's Guide, Frostig Program for the Development of Visual Perception, Chicago: Follett, 1964.

[88]McCarthy, J. J. and Kirk, S. A. The Illinois Test of Psycholinguistic Abilities, Examiner's Manual, Urbana, Ill.: University of Illinois Press, 1961.

concept derive their value from the problems which might be prevented.

Research needs to be based on a concept of perceptual patterning. Critical tests of the theory, such as the one by Bruininks[89], must be made, but with younger subjects. Such studies should compare the learning rates of subjects when presentation of stimulus materials is matched with their dominant modalities and when presented to their non-preferred modalities (see Bateman[90]). Closer consideration must also be given to design and to the perceptual batteries used to identify strengths.

This discussion has endeavored to present research concerning the general area of perception and, more specifically, ideas related to a theory of modality preferences in learning. It would be naive to think that individual differences in perceptual abilities are the answer to all the problems encountered in school. However, this area may offer a partial answer, and the school can be instrumental in determining it.

If a child can be described more precisely in terms of his unique pattern of learning abilities and if, consequently, he is treated differently, the age-old American philosophy of allowing each child to

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[89]Bruininks, R. H., "Relationship of Auditory and Visual Perceptual Strengths to Methods of Teaching Word Recognition Among Disadvantaged Negro Boys," Unpublished doctoral dissertation, George Peabody College for Teachers, Nashville, Tenn. 1963.

[90]Bateman, B., "Learning Disorders," Review of Educational Research, 1966, 36, 93-119.

reach his potentials for educational and personal growth would come one step closer to fulfillment. It may also be feasible to hope that a better description of the child might not only result in ways to retard the formation of learning problems, but it might also aid in raising the achievement levels of those who are not plagued by learning difficulties.

CHAPTER III

REVIEW OF RELATED RESEARCH - PART II

Intersensory Integration and Reading

The question of the psycholinguistic processes necessary for a child to adequately learn to read has often been considered. The common answers have been in terms of "getting meaning", making the material meaningful, and so forth. Until recently, there has been little concern for the underlying learning factors which contribute to the mechanics of the reading process. Recent research has led to realization of the importance of such non-meaningful level processes as immediate memory, auditory closure, and orientation to space to the ability to learn to read. Nevertheless the reason why such processes should be important to learning and reading is unclear. There are suggestions that the importance of these processes may lie in their effect on intersensory integration and coordination. If this be so, then such intersensory integration should be related to unifying concepts.[91]

Piaget's theory (Flavell)[92] relies heavily on the concept of schema.

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[91]Birch, R. G. and Lefford, A., "Intersensory Development in Children," Monographs of the Society for Research to Child Development, 1963, 28, No. 5 (Whole No. 89).

[92]Flavel, J. H., The Developmental Psychology of Jean Piaget, Princeton, N. J.: D. Van Nostrand Col, 1963.

"A schema is a cognitive structure which has reference to a class of similar action sequences, these sequences of necessity being strong, bounded totalities in which the constituent behavioral elements are tightly interrelated."[93] Within a totality is a group of mutually dependent elements unable to function without each other. These are schemas of vision, hearing, touch, taste, and so on. These schemas are developed through the dynamic processes of assimilation and accomodation. Assimilation is the process of changing elements in the environment in such a way that they become integrated into the already existing structures of the organism. Accomodation occurs whenever a given experience results in the modification of the organism in such a way that further transactions with the environment are made more probable and possible. In a young child, through these processes, new schemas are constantly being both created and integrated with other schemas. As the child grows older these initially separate schemata become integrated into new higher order schemas which in turn also go through a process of reciprocal assimilation.

> Observation shows that very early, perhaps from the very beginnings of orientation in looking, coordinations exist between vision and hearing...then between vision and comprehension, touch, kinesthetic impressions etc. These intersensorial coordinations, this organization of heterogeneous schemata will give the visual images increasingly rich meanings and

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[93]Flavel, J. H., The Developmental Psychology of Jean Piaget, Princeton, N. J.: D. Van Nostrand Co., 1963, pp. 52-53.

> make visual assimilation no longer an end in itself but an instrument at the service of vaster assimilations.[94]

An important point to remember here is that these intersensorial coordinations are thought necessary to development. A breakdown, then, in intersensory or intrasensory coordination of schemata will have an adverse effect on development. Normal development comprises the formation of organized, interlocking systems or networks of schemata. Assimilation and its resultant dynamic intercoordination of schemata are, for Piaget, a dominant component of development.

Another important point is that assimilation, the coordinative process, becomes an instrument of cognition after having been a goal. To say it differently, it becomes automatic and more covert. It becomes less and less dependent upon physical actions, more and more abstract, and more internalized. Hence, schemata become more manipulable in the organization of cognitive material. The discussion of the sensory-motor period[95] is replete with references to progressively more complex coordinations of schemata. In fact, this progression from primary to secondary to tetiary schemas and their coordination define this period of development which is a sine qua non for later developmental periods.

Cognitive growth, then, consists in part in the development of systems

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[94]Piaget, J., The Origins of Intelligence in Children, New York: International University Press, 1952.

[95]Flavell, J. H., The Developmental Psychology of Jean Piaget, Princeton, N. J.: D. Van Nostrand Co., 1963.

of representation as a means for dealing with information. The child proceeds from an action-pattern representation to a use of imagery and finally to the use of a symbol system.[96]

Bruner[97], in delineating these stages (action, iconic, and symbolic), emphasized that each stage subsumes the preceding one(s).

There is, then, some theoretical and empirical basis for saying that integration of sensory inputs from differing modalities is an ontogenetic phenomenon. Further support is found in Hebb's neuropsychological theory of cell assemblies into phase sequences, phase sequences into phase cycles, and phase cycles into series and classes of phase cycles, the organism will sense no single experiences such as a "delicious steak" but isolated units of sensory stimulation such as the aroma of a steak (small), its sizzling (auditory), or seeing it cooking (vision).

Birch and Lafford[98] published a monograph which reported on the progressive childhood growth of patterns of intersensory integration and complementarity. This was a direct outcome of their basic research

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[96]Bruner, J. S., "Course of Cognitive Growth," American Psychologist, 1964, 19, 1-15.

[97]Ibid. pp. 1-15.

[98]Birch, R. G. and Lefford, A., "Intersensory Development in Children," Monographs of the Society for Research to Child Development, 1963, 28, No. 5 (Whole No. 89).

derived from a comparative psychological viewpoint. As Birch[99] points out, and as discussed above, the evolution of behavior can be conceptualized as the process of development of intersensory patterning.

The Illinois Test of Psycholinguistic Abilities was developed using the early psycholinguistic theroy of Charles Osgood[100] which postulated three levels of organization: projection, integration, and representation. The integrative level is of particular importance here.

Wepman, Jones, Bock and Pelt[101] presented a theoretical model of language which includes a level of organization called "perceptual" which corresponds to Osgood's integrative level and McCarthy and Kirk's automatic-sequential level. This model was developed out of Wepman et al.'s clinical experiences with aphasics rather than from purely theoretical considerations as was Osgood's. Despite areas of difference, it is significant that these models, developed from differing

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[99]Birch, G. H., "Dyslexia and the Maturation of Visual Function," In J. Money (Ed.), Reading Disability: Progress and Research Needs In Dyslexia - Baltimore: Johns Hopkins Press, 1962, pp. 161-170.

[100]Osgood, C. E., A Behavioristic Analysis: Contemporary Approaches to Cognition, Cambridge: Harvard University Press, 1957.

[101]Wepman, J. M., Jones, L. V., Bock, R. D., and Pelt, D. V., "Studies in Aphasia: Background and Theoretical Formulations," Journal of Speech and Hearing Disorders, 1960, 25, pp. 323-332.

frames of reference, both recognized the necessity for and the importance of a stage of integration in which discrete sensory units become co-ordinated into one unit of experience.

Bateman[102], after extensive work with the Illinois Test of Psycholinguistic Abilities, presents a new expanded model of psycholinguistic processes which clearly shows the kinds of tests lacking in the Illinois Test of Psycholinguistic Abilities. She includes intersensory integration as one of the processes intermediate between receptive and expressive language. This is in addition to memory and closure processes which are already being sampled by the test.

The Illinois Test of Psycholinguistic Abilities is the principal instrument of its kind. It is one of the instruments used in this dissertation. The clinical model of the Illinois Test of Psycholinguistic Abilities (Table 1) presents three major dimensions--levels of organization, psycholinguistic processes, and channels of communication. Two levels of organization are identified; viz., the representational level and the automatic-sequential level.

> The representational (or meaningful) level...mediates activities requiring the meaning or significance of linguistic symbols, and
>
> The automatic-sequential (or non-meaningful) level...

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[102]Bateman, Barbara, "An Overview of Learning Disabilities," Paper presented at the Council for Exceptional Children 42nd Annual Convention, Chicago, Ill. March 31-April 4, 1964.

mediates activities requiring the retention of linguistic symbol sequences and the execution of automatic habit chains.[103]

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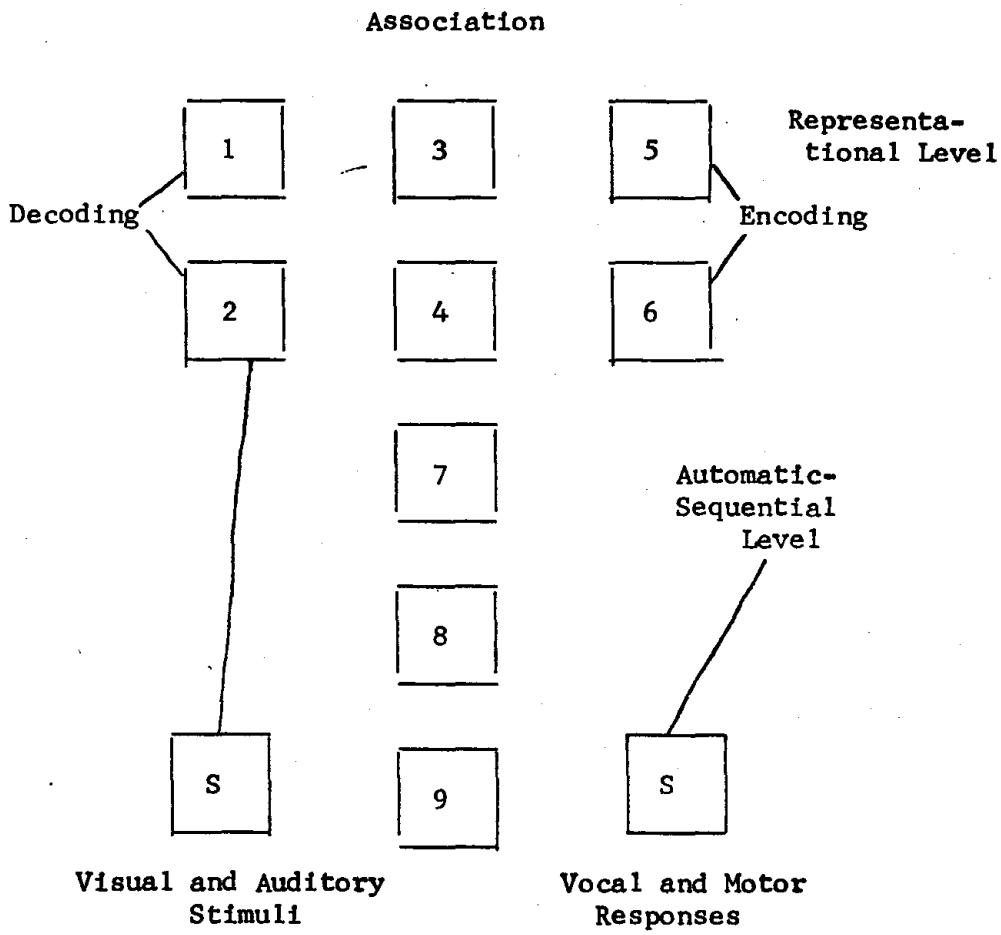
[103]Kirk, S. A. and McCarthy, J. J., "The Illinois Test of Psycholinguistic Abilities--An Approach to Differential Diagnosis." American Journal of Mental Deficiency, 1961, 66, p. 3.



Representational Level	Automatic-Sequential Level
1. Auditory Decoding	7. Auditory-Vocal Automatic
2. Visual Decoding	8. Auditory-Vocal Sequential
3. Auditory-Vocal Association	9. Visual-Motor Sequential
4. Visual-Motor Association	
5. Vocal Encoding	
6. Motor Encoding	

Table I
The Clinical Model for the
Illinois Test of Psycholinguistic Abilities[104]

[104]Kirk, S. A. and McCarthy, J. J., "The Illinois Test of Psycholinguistic Abilities--An Approach to Differential Diagnosis," American Journal of Mental Deficiency, 1961, 66, pp. 399-412.

Intersensory Integration Studies

Birch and Belmont[105] studied auditory-visual integration in 50 normal and 150 retarded readers. The task was an auditory-visual pattern matching task. Their findings were interpreted to mean that the breakdown in the ability to integrate the input from these two sensory modalities greatly increases the probability of a child becoming a poor reader. Deficiencies in either sense or in immediate auditory memory were ruled out.[106] These findings tended to be supported in the already discussed study of Birch and Belmont[107] using the same task with 220 American youngsters having a mean IQ of 120.3 (Otis Quick-Scoring Tests of Mental Ability). Since this was a dvelopmental study, reading ability was not a criterion for selection.[108] However, a rho correlation between reading and auditory-visual integration was significant at the first and second grade levels.[109]

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[105]Birch, H. G. and Belmont, L., "Auditory-Visual Integration in Normal and Retarded Readers," American Journal of Orthopsychiatry, 1964, 34, pp. 852-859.

[106]Ibid.

[107]Birch, H. G. and Belmont, L., "Auditory Visual Integration in Brain Damaged and Normal Children," Developmental Medicine and Child Neurology, 1965, 7, pp. 135-144.

[108]Ibid.

[109]Ibid.

Katz and Deutsch[110] [111] also related reading to the ability to shift from auditory to visual stimuli. Seven techniques were utilized. They found that poor readers showed significantly greater difficulty from one modality to another. Other pertinent results were: a) that modality preference was unrelated to reading ability: b) that significant differences on the discrimination tasks were not due to the level of familiarity of the material: and c) that good readers exhibited longer memory spans for both auditory and visual stimuli separately and combined. In summary, Katz and Deutsch[112] found significant differences between adequate and inadequate readers on all measures of intersensory equivalence which verified the results of an earlier study, (Raab, Deutsch, and Freedman)[113]. The Spaldings,[114] too, recognize the importance

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[110]Katz, Phyllis A. and Deutsch, M., "The Effects of Varying Modality of Stimulus Presentation in Serial Learning on Retarded and Normal Readers," Paper presented at the Psychological Association, April 1963.

[111]Katz, Phyllis A. and Deutsch, M., Visual and Auditory Efficiency and Its Relationship to Reading in Children, Cooperative Research Project No. 1099, Institute for Developments' Studies, Department of Psychiatry, New York Medical College, New York, 1963 (mimeograph copy).

[112]Ibid.

[113]Raab, Shirley, Deutsch, M. and Freedman, A. M., "Perceptual Shifting and Set in Normal School Children of Different Reading Achievement Levels." Perceptual and Motor Skills, 1960, 10, pp. 187-192.

[114]Spalding, Romalda B. and Spalding, W. T., The Writing Road to Reading, A Modern Method of Phonics for Teaching Children to Read, (Revised Edition) New York: Whiteside Inc. and William Morrow and Co., 1962.

of the integrational level of learning functioning as do McGinnis,[115] Bloomfield and Barnhart,[116] and Frostig.[117]

Hermelin and O'Connor[118] [119] found that elicitation of cross-modality responses enhanced the learning of familiar tasks by imbeciles[120] but interfered with the learning of tasks using unfamiliar materials.[121] The latter was explained by the fact that the stimuli were not easily named (Greek and Russian letters) thus preventing the translation from one type of sensory image into another. The former were also explained as a release

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[115]McGinnis, M. A. Aphasic Children: Identification and Education by the Association Method, Washington, D. C.: Alexander Graham Bell Association for the Deaf Inc., 1963.

[116]Bloomfield, L. and Barnhart, C., Let's Read: A Linguistic Approach Detroit: Wayne State University Press, 1963.

[117]Frostig, M., and Horne, D., Teacher's Guide, Frostig Program for the Development of Visual Perception, Chicago, Follett, 1964.

[118]Hermelin, Beate and O'Connor, N., "Like and Cross Modality Responses in Normal and Subnormal Children," Quarterly Journal of Experimental Psychology, 1960, 12, pp. 48-53.

[119]Hermelin, Beate and O'Connor, N.,"Recognition of Shapes by Normal and Subnormal Children," British Journal of Psychology, 1961, 52, pp. 281-284.

[120]Hermelin, Beate and O'Connor, N., "Like and Cross Modality Responses in Normal and Subnormal Children," Quarterly Journal of Experimental Psychology, 1960, 12, pp. 48-53.

[121]Hermelin, Beate and O'Connor, N., "Recognition of Shapes by Normal and Subnormal Children," British Journal of Psychology, 1961, 52, pp. 281-284.

from set, from the compelling force of direct stimuli which they tended to imitate rather than respond to.

The research hypothesizes that reading development depends on the coordination of the sense channels of vision and audition.[122] The breakdown in this coordination at a non-meaningful psycholinguistic level has already been demonstrated to be significantly related to reading achievement. Is it not logical, then, to question whether there are other intersensory coordination problems such as visual-kinesthetic, and haptic-kinesthetic which may also underlie reading failure? Such coordinations are developmentally important to the intellectual growth of the young child. They are thought to be also relevant to the mechanics of reading and primary reading problems. Further, integration of such sensory inputs must operate at an automatic, nonconscious level in order to be functional. It is postulated that this automatic coordination must operate before the child can make appropriate progress in reading. Since a minimal level of sensory integration is necessary for a successfully adequate development of the iconic stage and the subsumption of it by the symbolic stage of cognitive growth, it seems that learning to read also depends to some extent on this psycholinguistically lower level visual-haptic-kinesthetic integrative process. In this dissertation this has been controled by eliminating all subjects who did not possess integrative ability in the visual-haptic-kinesthetic integration process.

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[122]Bateman, B., "The Efficacy of an Auditory and a Visual Method of First Grade Reading Instruction with Auditory and Visual Learners," Curriculum.

Primary reading problems are characterized by primitive rotations and reversals, an inability to see the word as an entity, uncertain memory for shapes of letters, poor comprehension and slow reading speed according to Kolson and Kaluger[123]. These problems are conceptually associated with problems in mentally manipulating space and spatial properties as well as with poor visual memory.

Reading is a skill requiring integration of visual information with information relating to spatial direction and distribution. The reader must immediately and automatically distinguish between letters and words which present the same gestalt but differ only in direction or orientation such as b and d, p and q, x and n, saw and was, wordy and roundy, etc. Unlike a spoon which remains a spoon whether it is vertical, horizontal, upside down, or upside up, changes in the orientation of alphabetic symbols produce changes in meaning. Changes in the spatial arrangement of these symbols in words also produce changes in meaning. "Their positional sequence and not their mere presence is then of utmost importance" according to Money[124]. The reader, then, must make automatic judgments of laterality, direction, and spatial properties not only of the symbols

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[123]Kolson, C. J. and Kaluger, G., Clinical Aspects of Remedial Reading, Springfield, Ill.: Charles C. Thomas, 1963, p. 31.

[124]Money, J. (Ed.) Reading Disability: Progress and Research Needs in Dyslexia, Baltimore: Johns Hopkins Press, 1962, p. 18.

themselves but also of their relation to one another. This "directionality" is gained developmentally through tactual and kinesthetic sense data with reference to one's own body and the consciousness of one's own body. It involves "the relationship of the visual image to the body image in ahead and behind, toward and away--from, left and right, and facing upward or downward."[125] "Intersensorial coordinations", then, have occurred to the required degree. Tactile and kinesthetic schemata have been assimilated by the visual. Therefore, to rephrase an earlier sentence, reading is a skill requiring integration of visual information with information gathered from haptic and kinesthetic sensations. This is what the remedial approaches discussed attempt to facilitate. This dissertation has utilized this research in controlling the need of an individual to develop visual-haptic-kinesthetic integrative processes through the use of the Des Plaines Kindergarten Screening Test.

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[125] Ibid. p. 20.

First-Grade Learning

Assuming that children have predominant perceptual modes at a first-grade level, the feasibility of measuring the dominance seems to lie in the practicality of identification with group screening methods in that the time involved deems it all but impossible to make the determination with only individual testing procedures for all children. The impracticality of individual evaluation of perceptual abilities in regard to time, expense and small numbers of children who can benefit from individual evaluation, is all too obvious.

A fundamental premise of this dissertation is that inability to acquire reading skills is the result of deficiency in at least one of the perceptual modes, and that this deficiency is exacerbated when reading instruction is primarily aimed at the perceptual sphere in which the child has a relative weakness. Thus, teaching phonics, in a relatively "pure" form, will place a child at a disadvantage if he is delayed in auditory perceptual ability.

This chapter has two aims:

1. To clarify the relationship between auditory and visual perception.
2. To determine the minimum amount of variance in reading and at the first-grade level that can be accounted for by auditory and visual perception.

Review of the literature indicates that both modalities are separately important, but there is little information regarding the relative importance of each modality at the first-grade level, because very few studies have

examined both auditory and visual perception.

Many studies of auditory or visual perception, such as those characterized by DeHirsch, Durrel and Murphy, Goins, Keogh, and Wepman,[126] have provided evidence of a positive relationship between a single perceptual modality and reading ability. Some of the investigators successfully predicted achievement on the basis of strength or weakness in a single perceptual mode.

Wepman[127] suggested that children with poor auditory discrimination are likely to be poor readers, and this was corrobrated by Deutsch who found that poor readers have more difficulty than good readers with auditory discrimination tasks[128]. Deutsch went on to postulate that a "... minimum level of auditory discrimination is necessary..." for the acquisi-

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[126]DeHirsch, Katrina, "Tests Designed to Discover Potential Reading Difficulties at the Six-year Old Level," Amer. J. of Ortopsychiatry, 1957, 27, 566-576; Durrel, D. D. and Murphy, H. A., "Auditory Discrimination Factor in Reading Readiness and Reading Disability," Educ., 1953, 73, 556 560; Goins, Jean T., "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs, No. 87, Univer. of Chicago Press, 1958; Keogh, Barbara K., "Form Copying Tests for Prediction of First-Grade Reading," Claremont Reading Conference, Twenty-Seventh Yearbook. 1963, 141-144; Wepman, J. M., "Auditory Discrimination, Speech and Reading," Elem. School J., 1959, 60, 325-333.

[127]Wepman, J. M., "Auditory Discrimination, Speech and Reading," Elem. Schl. J., 1959, 60, 325-333.

[128]Deutsch, Cynthia, "Auditory Discrimination and Learning: Social Factors," Merril-Palmer Quarterly, Fall, 1964.

tion of reading and other verbal skills. A report of another study by Goetzinger, Dirks and Baer[129] indicated the affirmative side of the position by demonstrating that a small sample of good readers showed "superior ability" in auditory discrimination. Durrell[130] and Thompson[131] presented results from separate studies indicating a significant relationship between auditory discrimination and reading.

It was hypothesized by Hodges and Rudorf[132] that auditory perception is the most important modality for acquiring reading skill[133]. They went on to indicate that the auditory modality gains even more prominence when there is a consistent phoneme-grapheme relationship in the language. Also working in the area of reading, Bogda[134] demonstrated the importance of audi-

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[129]Goetzinger, C. P., Dirks, D. D., Baer, C. J., "Auditory Discrimination and Visual Perception in Good and Poor Readers," Annals of Otology, Rhinology, and Larvagology, 1960, 69, 121-136.

[130]Durrell, D. D. and Murphy, H. A., "Auditory Discrimination Factor in Reading Readiness and Reading Disability," Educ., 1953, 73, pp. 556-560.

[131]Thompson, Bertha B., "The Relation of Auditory Discrimination and Intelligence Test Scores to Success in Primary Reading," Unpublished Ph.D., Dissertation, Indiana Univer., 1961.

[132]Hodges, R. E. and Rudorf, E. H., "Phoneme-grapheme Relationships," Paper read at National Council of Teachers of English Annual Meeting, Cleveland, Nov. 1964.

[133] Ibid.

[134]Bogda, T. C., "Spelling Improvements: The Result of Multisensory Phonics," Minn. J. Ed., 1964, 44, 12-13.

tory perception in that a multisensory phonics program resulted in substantial increases in reading and that the program was most effective when it began in first grade. It should be pointed out that both Petzold[135] and Wepman[136] have shown a progressive development of auditory perception with age, and Petzold reported:

> The existence within each grade level of children with differences...of competence...in aural understanding further emphasizes the need for developing teaching procedures and activities which will take account of these differences, and result in more effective teaching on the part of all children[137]

Vernon says that visual perception was a proponent of the position that visual perception is the most important of the modalities in the acquisition of academic skills but felt that more of the studies should be done with children rather than adults[138]. Ryan, attempting to examine

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[135]Petzold, R. G., "Development of Auditory Perception of Musical Sounds by Children in the First Six Grades," J. Res. Mus. Educ., 1963, 11, 21-43.

[136]Wepman, J. M., "Auditory Discrimination, Speech and Reading," Elem. Schl. J., 1959, 60, 325-333.

[137]Petzold, R. G., "Development of Auditory Perception of Musical Sounds by Children in the First Six Grades," J. Res. Mus. Educ., 1963, 11, 21-43.

[138]Vernon, M. D., Backwardness in Reading, Cambridge, England: Cambridge Univer. Press, 1957.

the effects of visual perception at a more critical age, discovered that visual perceptual skill is of greatest predictive value at the kindergarten level, but less important in its correlation with reading attainment as the child passes through the primary grades[139]. As a result of his findings, he was one of the first to suggest that visual perceptual development of children be assessed at the kindergarten level. In a study with first-grade children, Goins[140] demonstrated the importance of visual perception in the "learning-to-read stage", and hypothesized that the visual perceptual tests she used would show a significant correlation with later reading success. Veto[141] in a more recent study, states that keen visual perception allows for a lot of incidental learning which facilitates the acquisition of reading.

There has been a series of studies that used visual perceptual tests which were quite verbal in nature and almost identical to reading. The

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[139]Ryan, Q. R., "Relative Importance of Intelligence and Visual Perception in Predicting Reading Achievement," Calif. J. of Educ. Res., 1964, 15, 44-48.

[140]Goins, Jean T., "Visual Perceptual Abilities and Early Reading Progress," Supplementary Educational Monographs, No. 87, Univer. of Chicago Press, 1958.

[141]Veto, J. M., "Understanding and Meeting Individual Needs in Spelling," Elem. Engl., 1964, 41, 753-754.

work of Gates[142], Sister Mary of the Visitation[143], and Sister Mary Phalen[144] were characteristic and seemed to use tests that appeared to be similar in content to the reading process. All three of the studies represent a similar shortcoming of using language-based perceptual tasks which seem to measure beginning achievement rather than a more "fundamental" kind of perceptual function, as measured by non-language perceptual tasks.

Although auditory and visual perception have been studied rather extensively, the relationship between these two perceptual modalities has received little consideration. Katz and Deutsch recently reported studies of both modalities, and that; practically all the auditory and visual skills tapped differentiated good from poor readers.[145] They

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[142]Gates, Arthur L., The Psychology of Reading and Spelling, New York: Teachers College, Columbia Univer. 1922.

[143]Visitation, Sister Mary of the, "Visual Perception in Reading and Spelling: A Statistical Analysis," The Catholic Univer. of Amer., Educ. Res. Bull., 1929, 4, 1-48.

[144]Phelan, Sister M., "Visual Perception in Relation to Variance in Reading and Spelling," The Catholic Univer. of Amer., Ed. Res. Monogr., 1940, 12, 1-43.

[145]Katz, P. A. and Deutsch, M., "Visual and Auditory Efficiency and Its Relationship to Reading in Children." Final Report, Project No. 1099, Cooperative Research Program, Washington: Office of Education, Department of Health, Education and Welfare, 1963.

indicated that retarded readers learned more rapidly via the visual modality presentations than through the aural modality, suggesting that the visual mode is the most important for acquisition of a beginning academic skill like reading.

Barrett[146] maintains that first-grade teachers can observe differences among their pupils in the performance of visual perceptual tasks, which will determine their readiness to read. His findings showed that a combination of visual perceptual tasks account for a sufficient amount of variance in predicting beginning reading achievement to warrant a careful evalustion of these elements early in a child's school career, However, he points out that the visual perceptual factors:

> ...did not provide enough predictive precision to warrant their use alone in predicting first-grade reading achievement for individuals. In fact,...visual discrimination information must be supplemented...in other readiness areas, e.g., auditory discrimination...if accurate decisions about reading readiness are to be made in the classroom.[147]

The review of literature indicates that geometric form reproduction (copying of geometric figures)--a type of functional integration of visual-motor abilities--related to acquisition to academic achievement. It

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[146]Barrett, C., "Visual Discrimination Tasks as Predictors of First-Grade Language Reading Achievement," The Reading Teacher, 1965, 18, 276-282.

[147]Ibid. pp. 276-282.

should be noted that in this context, visual refers to visual perception and not merely to the sensory function.

Difficulty integrating one modality with the other is likely to be a characteristic of children with reading difficulties. Studies by DeHirsch, Koppitz, Smith and Keogh, Walters, and Wilson,[148] are representative of some of the interest shown in the visual-motor aspects of early learning. For example Koppitz found significant correlations between the Bender-motor Gestalt Test, two reading readiness tests, and a reading achievement test. The study by Katz and Deutsch[149], is one of auditory-visual perceptual patterning which indicates the importance of more than one perceptual modality in relationship to reading. Studies by

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[148]DeHirsch, Katrina, "Tests Designed to Discover Potential Reading Difficulties at the Six-year Old Level," Amer. J. of Ortopsychiatry, 1957, 27, 566-576; Koppitz, E. M., "Bender Gestalt Test and Learning Disturbances in Young Children," J. of Clin. Psychol., 1958, 14, 413-416; Smith, Carol and Keogh, Barbara, "The Group Bender Gestalt as a Reading Readiness Screening Instrument," Percep. and Motor Skills, 1962, 15, 639-645; Wilson, F. J., Flemming, C. W., "Reversals in Reading and Writing Made by Pupils in the Kindergarten and Primary Grades," J. of Gen. Psychol., 1938, 53, 3-31.

[149]Katz, P. A. and Deutsch, M., "Visual and Auditory Efficiency and Its Relationship to Reading in Children," Final Report, Project No. 1099. Cooperative Research Program, Washington: Office of Education, Department of Health, Education and Welfare, 1963.

Potter, Robinson, and Walters[150] have indicated that geometric form reproduction accounts for as much as thirty-six per cent of the variance in reading achievement. Russell[151] attended to the importance of more than one perceptual mode in reading acquisition by indicating that it simultaneously involves sensation, perception, and motor function (e.g., eye movements).

In one of the earliest studies of visual-motor perception, as related to learning in the classroom, Chinnappa emphasized its importance by stating:

> Finally, the most incredible rapidity and excellence with which children between five and six years of age learn to read, write and cipher, and draw in the Montessori Schools in Rome, is due among other things to the fact that nearly all the preliminary exercises leading to these arts are based on the development of form perception[152]

Either poor motor control, or poor visual perception, will affect the

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[150]Potter, Muriel C., "Perception of Symbol Orientation and Early Reading Success," Contributions to Education, No. 939, New York: Teachers College, Columbia Univer., 1949; Robinson, Helen M., et al, "Childrens Perceptual Achievement Forms: A Three Year Study," Amer. J. Optom., 1960, 37, 223-237; Walters, C. Etta, "Reading Ability and Visual Motor Function in Second Grade Children," Percep. and Motor Skills, 1961, 13, 370.

[151]Russell, D. H. Children Learn to Read, Boston: Ginn and Co., 1961.

[152]Chinnappa, S. P., "A Study of Visual Perception of Form in Children," Unpublished A. M. Thesis, Univer. of Chicago, 1914, pp. 58-59.

quality of geometric form reproduction. As a child approaches school age, his reporductions of geometric figures increasingly become a representation of the original. However, "pure" cases of either visual imperfection or lack of motor control are infrequent. Koppitz provides a convenient rule of thumb to determine the nature of the problem. If the difficulty is primarily motor, the child will recognize his errors; if it is a visual-perceptual problem, he will not recognize them as errors[153]. Vereeckan provides evidence indicating that failures in form reproduction are not merely a matter of poor motor control or inability to move a pencil, since he found that the same or similar distortions were made while using sticks as the materials for reconstructing the geometric figures.[154]

In conclusion, it seems as though auditory and visual perceptual abilities having positive correlation with reading achievement as the first-grade level can be measured, and that these findings represent a first small step toward gathering more information leading to solution of the pedagogical problem of matching children according to their individual proclivities with the appropriate mode of instruction.

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[153]Koppitz, E. M., "Bender Gestalt Test and Learning Disturbances in Young Children," J. of Clin. Psychol., 1958, 14, 413-416.

[154]Vereeckan, P. Special Development, Groningan: J. B. Walters, 1961.

CHAPTER IV

RESEARCH EXPERIMENT

Hypothesis

The research of the previous studies have proven the importance of setting up a plan to study in detail a comparison of varied reading instructional programs as interrelated with modes of learning. Thus, in seeking proof and in drawing conclusions the following null hypothesis were studied.

1. There is no practical pedagogical advantage to the efficiency of the teaching-learning process to match children according to their individual proclivities with the appropriate mode of instruction.
2. Students whose learning styles are different will read at the same level in a given environment.
3. First grade reading achievement is not related to the instructional program used to teach reading.
4. First grade reading achievement is not related to intelligence as measured by instruments utilized in this dissertation.
5. Modality development does not predict reading success.
6. Standardized reading readiness tests used in this dissertation are not related to reading success.

STEPS TO TAKE

The following steps were taken in order to design a research experiment to study the null hypothesis.

1. Identify the proclivities of children that will be included in the population.
2. Provide empirical basis for selection of tests to be used during the experiments.
3. Compare test results with personal observation and spontaneous teacher comment to assess validity of test instruments.
4. Assign and explore the relationship between auditory discrimination abilities and reading achievement. The major portion of the research has been correlational as stated in the chapter under research. There is a definite need for research of an experiental nature to venture further into this area[155] as well as into the total perceptual abilities - reading achievement picture.
5. Explore the efficacy of accomodating reading instructional programs to children's proclivities. The theory of mode of learning will be acclaimed viable only to the degree that it holds up under classroom conditions.[156]

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[155]Robert Dykstra, "Auditory Discrimination Abilities and Beginning Reading Achievement," Reading Research Quarterly, 1:33, Spring, 1966.

[156]Joseph M. Wepman, "The Perceptual Basis for Learning," Meeting Individual Differences in Reading. Proceedings of the Annual Conference on Reading Held at the University of Chicago, 1964 (Chicago: University of Chicago Press, 1964), pp. 31-32.

6. To test the hypothesis previously formulated and stated.

Subjects

The subjects used in the process of this study are taken from a Chicago suburban population of two thousand children. They all were first grade children between the chronological ages of six years zero months old and six years four months old. They were screened to determine if they were auditory learners, visual learners, or strong auditory and visual learners. They were identified as being auditory learners if they could successfully complete ninety per cent of all auditory tasks asked of them. They were identified as being visual learners if they could successfully complete ninety per cent of all visual tasks required of them. They were identified as being random learners if they could successfully complete ninety per cent of all visual and auditory tasks.

From this screening procedure a sample of five hundred forty children remained. These children were assigned according to their modalities into eighteen classrooms.

The eighteen classrooms were: nine using the Initial Teaching Alphabet (I.T.A.) and nine using the Ginn 360 Series (Basal Program). The Initial Teaching Alphabet program was used because of its heavy stress on auditory strengths and the Ginn 360 Series was used because of its heavy stress on the visual strengths.

Table II shows the distribution of clasrooms.

TABLE II

DISTRIBUTION OF CLASSROOMS

	School Building	Total First Grades in Building	Number of Children Assigned
Using Initial Teaching Alphabet Program (Auditory Method)	A	2	60
	B	3	90
	C	3	90
	D	1	30
	Total	9	270
Using Ginn 360 Program (Basal Method)	E	3	90
	F	3	90
	G	2	60
	H	1	30
	Total	9	270

The distribution of classrooms was done according first of all to method being taught and secondly according to space available for this research in the building. All classes had a population of thirty students. The codes under school building are arbitrarily lettered to conceal the identify of the school and the children involved.

From the population of five hundred forty a smaller population was arrived at consisting of those children with intelligence quotients over one hundred ten and those between seventy five and ninety. Considering the high intelligence quotients and low intelligence quotients from our population of five hundred forty the researcher arrived at a sample of one hundred forty four useable students to test all of the research hypothesis. The group of one hundred forty four children was broken down further into six different groupings consisting of twenty four children in each of the following categories:

1. Auditory mode children with high intelligence quotients
   (twenty four children)
2. Auditory mode children with low intelligence quotients
   (twenty four children)
3. Visual mode children with high intelligence quotients
   (twenty four children)
4. Visual mode children with low intelligence quotients
   (twenty four children)
5. Random assigned children (those with high auditory and high visual abilities) with high intelligence quotients
   (twenty four children)
6. Random assigned children
   (those with high auditory and high visual abilities)
   with low intelligence quotients
   (twenty four children)

From this sample of one hundred and forty four children (six groups

of twenty four children each), the groups were split into two; half of each group was assigned to the Initial Teaching Alphabet Method, hereafter referred to as the auditory method, and half to the Ginn 360 series, hereafter referred to as the visual method. (See Table III).

TABLE III

SAMPLE OF 144

		Classroom With Auditory Method (Initial Teaching Method)	Classroom With Visual Method (Ginn 360 Series)
Auditory Mode Children	High I.Q.	Four Cases - A Four Cases - B Four Cases - C	Four Cases - E Four Cases - F Four Cases - G
	Low I.Q.	Four Cases - A Four Cases - B Four Cases - C	Four Cases - E Four Cases - F Four Cases - G
Visual Mode Children	High I.Q.	Four Cases - A Four Cases - B Four Cases - C	Four Cases - E Four Cases - F Four Cases - G
	Low I.Q.	Four Cases - A Four Cases - B Four Cases - C	Four Cases - E Four Cases - F Four Cases - G
Random Assigned Children	High I.Q.	Four Cases - B Four Cases - C Four Casea - D	Four Cases - E Four Cases - F Four Cases - H
	Low I.Q.	Four Cases - B Four Cases - C Four Cases - D	Four Cases - E Four Cases - F Four Cases - H

This table shows the breakdown of children by method of learning, that is whether they are auditory learners, visual learners or random learners. (high visual and auditory learners). The table breaks down the research population of five hundred forty into the remaining one hundred

forty four sample used to test the hypothesis in this study. The table points out the number of cases in each of the six categories and then shows the breakdown of these cases as they were randomly assigned to either an auditory method or visual method classroom. The table also points out how the cases were randomly assigned to each of the eighteen classrooms. Four high intelligence quotients and four low intelligence quotients were arbitrarily assigned to each of these eighteen classrooms.

Instruments

By the use of individual and group screening instruments and teachers' observations, the children were identified as being auditory, visual or random (high auditory and visual) learners.

The tests were administered to the children at the end of their kindergarten year. They were scheduled to attend grade one in the following September. The tests were administered by the kindergarten teachers or the researcher.

The following test instruments were used in the study.

1. Intelligence Test

   a. Lorge-Thorndike Intelligence Test. Primary Battery Level I (hereafter referred to as LT). The alternate forms reliability of Lorge-Thorndike Intelligence tests for level I is .810[157]. The technical manual for the Lorge-Thorndike Intelligence tests lists several validity statistics which tend to fall in the .60 to .80 range.[158] More extensive statistical information is available in Buros' Fifth Mental

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[157] Irving Lorge and Robert L. Thorndike, Lorge-Thorndike Intelligence Tests Technical Manual (Boston: Houghton Mifflin Company, 1962), p. 8.

[158] Lorge, op. cit., pp. 16-22

Measurement Yearbook.[159] This test was administered by the classroom teacher.

2. Readiness Tests

a. Metropolitan Readiness Test (hereafter referred to as MRT)

Reliability and validity information is available in Buros' handbook.[160] This test was administered and scored by the kindergarten teacher.

b. Gates - McGintie Readiness Test (hereafter referred to as G-MG)

Reliability and validity information is available in Buros' handbook.[161] This test was administered and scored by the examiner.

3. Auditory Tests

a. Non-Verbal Auditory Discrimination Test (hereafter referred to as NVAD) developed by Dr. N. A. Buktenica of Peabody College, Nashville, Tenn. The reliability of the NVAD test is based on test results of four hundred ninety five children at six year age level. The same children were retested

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[159] Oscar K. Burns (ed.), Fifth Mental Measurements Yearbook (Highland Park, New Jersey: Gryphon Press, 1959), pp. 478-479.

[160] Oscar K. Buros, Fourth Mental Measurements Yearbook (Highland Park, New Jersey: Grypon Press, 1953, pp. 605-606.

[161] Ibid., pp. 302-3.

over a three year period. A reliability coefficient of .75 was calculated using the Kuder-Richardson formula 20. Validity statistics include a correlation of .36 between NVAD test and Intelligence Quotients obtained from SRA PMA test. Both correlations are statistically significant at greater than .001 level with an N of four hundred ninety five children, six years of age. This test was administered by the examiner.

b. Auditory Discrimination Test developed by J. M. Wepman Reliability and validity information is available in Buros' Handbook.[162] This test was administered by the examiner.

4. Visual Tests

a. Developmental Test of Visual-Motor Integration (hereafter referred to as VMI) developed by Dr. K. E. Beery and Dr. N. A. Buktenica. Reliability and validity statistics are detailed in the monograph that accompanies the VMI test.[163] This test was administered to the kindergarten classes as a group by the classroom teachers.

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[162]Oscar K. Burns, Fourth Mental Measurements Yearbook (Highland Park, New Jersey: Grypon Press, 1953, pp. 707-7).

[163]Keith E. Beery, Visual-Motor Integration (Chicago: Follett Publishing Company, 1967), pp. 34-37.

b. Developmental Test of Visual Perception (hereafter referred to as DTVP) was developed by Marianne Frostig[164] in 1964. This test was administered by the examiner and the classroom teacher.

d. University of California at Los Angeles Visual Discrimination Inventory (hereafter referred to as VDI) has been constructed by Lombard and Stern.[165] To avoid eye-hand coordination usually required on these tests, a selection rather than a drawing response was designed into VDI. Reliability, face validity and construct validity have been established and are reported in Buros'. This test was administered by the examiner.

5. Multi-ability tests

a. Illinois Test of Psycholinguistic Abilities (hereafter referred to as ITPA) authored by James J. McCarthy and Samuel

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[164]Marianne Frostig, "Visual Modality -- Research and Practice," Perception and Reading, Proceedings of the 12th Annual Convention of the International Reading Association, vol. 12, part 4 (Newark, Delaware: International Reading Association, 1968), p. 28.

[165]Avima Lombard and Carolyn Stern, "An Instrument to Measure Visual Discrimination of Young Children," ERIC #ED 015 510 (June, 1968, vol. 3 #6).

Kirk.[166] The Illinois Test of Psycholinguistic Abilities is pointed out by Wepman[167] as being of particular value in identifying modality differential at the conceptual level. Hurley[168] found that the deficits identified by the Illinois Test of Psycholinguistic Abilities were related to learning and reading achievement. The test was used to determine auditory strengths, visual strengths and auditory and visual strengths together. It was analyzed by counting a strength as the ability to have a psycho-linguistic age equivalent to or higher than the subjects chronological age. The test was administered by the examiner and the classroom teacher.

b. Purdue Perceptual Motor Survey (hereafter referred to as PPMS was designed by Roach and Kephart. Normative data and instructions for administering and scoring are contained in the text.[168] The test was administered by the examiner.

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[166]Joseph M. Wepman, "The Modality Concept -- Including a Statement of the Perceptual and Conceptual Levels of Learning," Perception and Reading, Proceedings of the 12th Annual Convention of the International Reading Association, vol. 12, part 4 (Newark, Delaware: International Reading Association, 1968), p. 6.

[167]Oliver L. Hurley, "Intersensory Integration and Reading, A Theory," ERIC #ED 017 091 (August, 1968, vol. 3 #8).

[168]Eugene G. Roach and Newell C. Kephart, "The Purdue Perceptual Motor Survey, A Direct-Action Approach to Non-Achiever Problems," ERIC #ED 331 (July, 1968, vol. 3 #7).

c. Perceptual Survey Rating Scale (hereafter referred to as PSRS) is described by Kephart in his text.[169] The test was administered by the examiner.

d. Des Plains Kindergarten - First Grade Screening Test

The test has not been standardized. It was used to analyze tasks the children could or could not perform. The criterion for counting a strength in a particular task was being able to completely do the task required of the subject. The test was administered by the examiner and the classroom teacher.

e. Slingerland - First Grade Screening Test

This test was scored and only those who rated high on a given task in the final analysis sheet were scored to be that classification of learner, that is to say auditory, visual or random.

6. Reading Achievement Tests

a. Metropolitan Achievement Test -- reading subtest (Mat.) Statistical information is available in Buros' Sixth Mental Measurement Yearbook.[170] This test was administered

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[169]Kephart, op. cit., pp. 120-155.

[170]Oscar K. Buros (ed.), Sixth Mental Measurements Yearbook (Highland Park, New Jersey: Gryphon Press, 1965), pp. 1073-1074.

by the classroom teacher.

Appendix A shows the correlation with transgeneration of the thirty six variables that were measured in this dissertation by using the instruments that were described.

Appendix B shows the variance-covariance matrix of the thirty six variables.

Appendix C Shows the correlational matrix of the thirty six variables. The variables that were controled in this dissertation were as follows:

1. Metropolitan Achievement Test - reading subtest.
   This test was recorded in percentile figures.
2. Intelligence Test - Lorge-Thorndike Intelligence Test.
   Primary Battery Level 1.
3. Modality through which the subject shows strength. By this the dissertation has signified that the learner is:
   A. An auditory learner - successfully completing ninety per cent of all auditory tasks.
   B. A visual learner - successfully completing ninety per cent of all visual tasks.
   C. A random learner - successfully completing ninety per cent of all auditory and visual tasks.
4. Metropolitan Reading Test - This score was recorded in percentile figures.
5. Gates-McGintie Test - This score was recorded in percentile figures.
6. Slingerland - First Grade Screening Test

This item was used to task analyze the task of visual discrimination of letter form. If the subject had no problem, he received a plus; if he experienced problems he received a zero on this task.

7. Slingerland - First Grade Screening Test -

This item was used to task analyze the task of visual ability to know the alphabet by sight. The subject received a plus if he experienced no problem on this task and if he could not complete the task he received a zero.

8. University of California at Los Angeles Visual Discrimination Inventory. The subject received a plus if he experienced no problem on these tasks and, if he could not complete the tasks, he received a zero.

9. Slingerland - First Grade Screening Test -

This item was used to analyze the tasks of the visual ability to see a visual form and reproduce it correctly without reversing it. The subject received a plus if he could successfully complete the tasks and a zero if failure was experienced.

10. Slingerland - First Grade Screening Test -

This item was used to analyze the tasks of the visual ability to see a visual form and reproduce it correctly without inverting the tasks. The subject received a plus if he could successfully complete the tasks and a zero if failure was experienced.

11. Slingerland - First Grade Screening Test -

This item was used to analyze the tasks of the visual ability of the

subject to visually see a whole word. The subject received a plus if he could successfully complete the tasks and a zero if failure was experienced.

12. Slingerland - First Grade Screening Test -

This item was used to analyze the task of the subject's ability to visually complete a gestalt presented in the form of a picture. The subject received a plus if he could successfully complete the tasks and a zero if failure was experienced over ten per cent of the time.

13. Slingerland - First Grade Screening Test -

This item was used to analyze the visual memory skills. If the subject could complete ninety per cent of the visual memory tasks, he received a plus; if he could not, he received a zero.

14. Developmental Test of Visual - Motor Integration -

This item was held constant as was item nineteen, which was gross visual motor ability as measured by the Purdue Perceptual Survey Rating Scale. Also item twenty-five was held constant which was gross motor ability as measured by the Des Plaines Test. The reason these items were task analyzed and held constant was their reported affect on research as was stated in the chapters on "Related Research".

15. Slingerland - First Grade Screening Test -

This item was used to analyze the visual ability of the subject to see visual matchings. If the subject scored ninety per cent of these items correctly, he received a plus, if he scored under this percentage, he received a zero.

16. Slingerland - First Grade Screening Test -

This item was used to analyze the visual ability to copy correctly. If the subject scored these items correctly, he received a plus: if he could not do those tasks correctly, he received a zero.

17. Developmental Test of Visual Perception -

This item was used to task analyze the visual perception field. If the subject scored satisfactory on this complete test, he was given a plus. If failure was noted in any area, a zero was given.

18. Slingerland - First Grade Screening Test -

This item was a compilation of all visual tasks administered on the Slingerland. The subject received a plus if all visual items on the test previously analyzed were plus. The subject received a zero if one of the items were negative.

19. Visual Motor Abilities -

This item was task analyzed from three separate tests: Des Plaines Kindergarten Test, the Purdue Perceptual Motor Survey and the Perceptive Survey Rating Scale. The subjects used in this research had to score a plus on all of these tasks.

20. Des Plaines Kindergarten Test -

This item was task analyzed on the task of visual discrimination. The subject scored a plus if he could satisfactory do the visual discrimination tasks and a zero if any of the tasks could not be done.

21. Des Plaines Kindergarten Test -

This item was used to analyze visual memory abilities. The subject received a plus if he scored at his chronological age or above and

a zero if he scored below his chronological age on this item.

22. Des Plaines Kindergarten Test -

This item was used to analyze spatial relationships. If the subject completed all the tasks correctly, he received a plus: if any were missed he received a zero.

23. Des Plaines Kindergarten Test -

This item was used to analyze figure-ground ability. If the tasks were done successfully ninety per cent of the time, the subject received a plus. If he did them satisfactorily less than ninety per cent of the time, he received a zero.

24. Des Plaines Kindergarten Test -

This item was used to determine enclosure ability. The subject received a plus if all items could be done successfully and a zero if any item of the tasks were missed.

25. Des Plaines Kindergarten Test -

This item was also used to analyze gross motor ability. This task had to be done at the ninety percentile to be passed. All subjects used in this research experiment had to pass this item at the ninety or above percentile.

26. Des Plaines Kindergarten Test -

This item was used to assess fine motor ability. The subject received a plus if he could do ninety per cent of the tasks and a zero if he scored below that percentile.

27. Slingerland - First Grade Screening Test -

This item was used to task analyze auditory discrimination abilities. The subject received a plus if he scored in the range on this item and a zero if he scored below that level.

28. Gates - McGintie Readiness Test -

Auditory Word Meaning Sub-test.

This item was scored a plus for those subjects able to pass ninety per cent of the auditory word meaning tasks and a zero for those subjects scoring below the ninety percentile.

29. Gates - McGintie Readiness Test -

Auditory Listening Sub-test.

This item was scored a plus for those subjects able to pass ninety per cent of all of the auditory listening tasks and a zero for those subjects scoring below the ninety percentile.

30. Gates - McGintie Readiness Test -

Auditory Sound Blending

This item was scored a plus for those subjects able to pass ninety per cent of all of the sound blending tasks and a zero for those subjects scoring below the ninety percentile.

31. Gates - McGintie Readiness Test -

Following Directions Sub-test.

This item was scored a plus for those subjects able to pass

ninety per cent of all of the tasks requiring following of directions and a zero for those subjects scoring below the ninety percentile.

32. Non-verbal Auditory Discrimination Test _

This item was scored a plus for those subjects showing a satisfactory or better score for their chronological age and a zero for those subjects not scoring at least at their chronological age.

33. Slingerland - First Grade Screening Test -

This item was scored a plus if all the subtests were scored at the high level. It was scored zero if any of the items on the test were below the high level. All of the random learners scored a plus on this item.

34. Illinois Test of Psycho-linguistic Abilities -

All Auditory Sub-tests.

This item was scored a plus if all auditory items showed a psycho-linguistic age equivalent to or higher than the chronological age of the subject. A zero was given if the psycho-linguistic age was below the chronological age. All auditory and random learners scored a plus on this item.

35. Illinois Test of Psycho-linguistic Abilities -

All visual Sub-tests.

This item was scored a plus if all visual items showed a psycho-linguistic age equivalent to a higher than the chronological

age of the subject. A zero was given if the psycho-linguistic age was below the chronological age. All visual and random learners scored a plus on this item.

36. Wepman - Auditory Discriminatiory Test.

This item was scored plus if the "Y" score was zero and the "X" score was three or under. The item was scored zero if the "Y" score was over zero and the "X" score over three.

All of the subjects used in this research experiment have met the following criteria. All of them passed items fourteen, nineteen and twenty-five. All of the learners classified as visual learners scored with a psycho-linguistic age the same or higher than their chronological age on the visual sub-tests of the Illinois Test of Psycho-linguistic Abilities. All of the learners classified as auditory learners passed with a psycho-linguistic age the same or higher than their chronological age or the auditory sub-tests of the Illinois Test of Psycho-linguistic Abilities. All of the learners classified as random learners passed with a psycho-linguistic age the same or higher than their chronological age on the visual and auditory sub-tests of the Illinois Test of Psycho-linguistic Abilities. Also the learners who were classified as random learners passed all items on the Slingerland First Grade Test in the high range and were scored with a plus on item twenty-eight.

The question this dissertation faced was, "Why the use of these test instruments or parts of these test instruments?" These test instruments were used because of four criteria. One, the tests were valid. They

did in fact measure what they said they would measure. This was also verified in the main throughout the research literature. This factor was important in establishing the samples in this experiment who achieved best in the various modalities. Secondly, the tests were reliable. On a random sampling of the research population with equal forms tests or equivalent tasks the same results were obtained at a significant level greater than .001. Thirdly, the test instruments acted as good screening instruments for use in a task analysis research experiment. This is covered in detail in the last chapter. Fourthly, the test instruments were good in that they could be used most expediently as far as individually and group screening of the experimental population.

Classrooms designated A_sA_m[171] were Auditory mode children combined with an auditory method. Visual mode children in an auditory program were designated as V_sA_m [172] R_sA_m[173] classrooms had random assignment of children (in terms of proficiency in both modes of learning). The classrooms which had auditory mode children in a vision method program were termed A_sV_m. In the V_sV_m classes, visual mode children were taught via a visual method.

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[171] A_s= Auditory subject
A_m= Auditory modality

[172] V_s= Visual Subject
A_m= Auditory modality

[173] R_s= Random subject
(Either visual and/or auditory learner)
A_m= Auditory modality
V_m= Visual modality

All testing was completed during an eight week period beginning in the spring of the subjects' kindergarten year. A uniform testing time schedule was followed so that the same test was administered by the kindergarten teacher or examiner during the same week at all of the schools utilized in this experiment.

During March and April of the subjects' kindergarten year there were orientation sessions held with the kindergarten and first grade teachers.

TABLE IV

DISTRIBUTION OF MODES AND METHODS

			Methods	
			Visual (Ginn 360 Basal)	Auditory (I.T.A.)
SUBJECTS	Children's Modes of Learning	Visual Mode	Visual Subjects Visual Method V_sV_m	Visual Subjects Auditory Method V_sA_m
		Auditory Mode	Auditory Subjects Visual Method A_sV_m	Auditory Subjects Auditory Method A_sA_m
		Random Visual and Auditory	Random Subjects Visual Method R_sV_m	Random Subjects Auditory Method R_sA_m

The table shows the coding of the subjects as they are matched with the classroom (mode of learning) they experienced during the experiment.

The qualifications of the teachers were held constant in that the following was met by all the teachers involved in the experiment. All the teachers had a minimum of three years experience teaching first grade. All the teachers taught first grade the previous two years before this experiment. All the teachers had at least two years experience using the method they taught during the experiment, that is, they had been using previously either the Initial Teaching Alphabet or the Ginn 360 Basal Series.

Also during the year four inservice meetings were held for the teachers in each of the methods reinforcing the skills of the programs they were taaching. Because of the number of classrooms, that is eighteen, the qualification of the teachers it was felt was approximately as even as could be humanly controled.

Procedure

1. A program was established after reviewing numerous tests to assess kindergarten children's learning modes. The tests used in this experiment are listed in detail in the section under "Instruments" in this chapter. Also the criteria for selection of the tests utilized in this dissertation are covered in the section "Instruments".
2. On the basis of the test results, the subjects were grouped for first grade assignments. For experimental purposes half of each group of learners was assigned to the Initial Teaching Alphabet and the other half was assigned to the Ginn 360 Basal Series. Assignment for this division was randomly done, except for control of intelligence quotients. Table I describes the arrangement of the children's mode of learning coupled with their assigned method of instruction.
3. The children were then instructed for nine months by either the Initial Teaching Alphabet or the Ginn 360 Basal Series. After the nine months in first grade the children were then retested, using the Metropolitan Achievement Test, the reading subtest. An analysis of variance using the F ratio was then done on all the children to test the hypothesis stated in this dissertation. The significance of these results is reported in the last chapter on "Results and Discussion."

TABLE V

CHILDREN'S MODE OF LEARNING COUPLED WITH THEIR ASSIGNED METHOD OF INSTRUCTION

School	Total First Grades in Building	Children	Method	A_SA_m	V_SA_m	R_SA_m	R_SV_m	V_SV_m	A_SV_m
A	2	A	A	1					
		V			1				
B	3	A	A	1					
		R	A			1			
		V	A		1				
C	3	A	A	1					
		R	A			1			
		V	A		1				
D	1	F	A			1			
E	3	A	V						1
		R	V				1		
		V	V					1	
F	3	A	V						1
		R	V				1		
		V	V					1	
G	2	A	V						1
		V	V					1	
H	1	R	V				1		
		Sub Total		3	3	3	3	3	3
		Total				18			

This table describes the arrangement of the children after their mode of learning had been established through testing and screening. The table describes the type of method used in the classroom to which the children were assigned.

Design

As stated under the section in this chapter "Subject" the population screened for this dissertation was a group of two thousand children. The population represented children from middle-class white, lower-class white, and lower-class Negro backgrounds. The socio-economic factor was not a criterion in this research design except that all the children were scored equally on their ability to handle a task that was task analyzed or their inability to perform the task.

All of the children in this experiment were controled for intelligence quotients in the following three categories. They were placed in the category "high intelligence quotient" if they scored over 110 on the Lorge-Thorndike Intelligence Test - Primary Battery Level 1. They were placed in "average group" if they scored on the Lorge-Thorndike Intelligence Test-Primary Battery Level 1, between 90-110. They were placed in the "low intelligence group" if they scored on the Lorge-Thorndike Intelligence Test Primary Battery Level 1 between 78 and 90. Seventy eight was an arbitrary cut off to the research experiment because all of the population scored at the 78 intelligence quotient level or higher.

The original population of two thousand children were screened and task analyzed to be: 1) auditory learners, 2) visual learners, or 3) random learners - high auditory and high visual learners. This produced a sample of five hundred and forty subjects.

To test the hypothesis stated in this dissertation only those with high intelligence quotients and low intelligence quotients were used. This

TABLE VI

SAMPLE OF ONE HUNDRED FORTY FOUR

Auditory Mode Children	High I.Q.	24
	Low I.Q.	24
Visual Mode Children	High I.Q.	24
	Low I.Q.	24
Random Assigned Children	High I.Q.	24
	Low I.Q.	24

Total 144

This table shows the number of usuable subjects that remained from the initially screened population of two thousand students in this experiment.

produced an even smaller usuable sample of one hundred forty four subjects. The breakdown of these subjects is shown in Table VI.

After the subjects were screened and modes of learning were established they were assigned to either a visual method or an auditory method classroom for the first grade school year. This is shown in detail under "Procedure" in this chapter.

At the end of the subjects' nine months in first grade, they were re-tested using the Metropolitan Achievement Test - the reading sub-test. The means of the reading achievement scores were calculated for each cell. Then, utilizing the factorial analysis of variance (F test) technique, significant results, in the research hypothesis, if present were revealed. The significance and results of these findings is discussed in the last chapter.

The classrooms were controled in that the population of each classroom was restricted to thirty students. All the students in each classroom in this experiment were either auditory, visual or random learners. Each classroom used in this experiment had four children with intelligence quotients over 110 and four children with intelligence quotients under 90.

The teachers assigned to these classrooms, either Initial Teaching Alphabet or Ginn 360 Basal Series, were assigned on a voluntary basis.

As was stated earlier, no control was made for new versus old children to the area, or black versus white students except that the criteria had to be met of either passing or failing the task that was being analyzed.

CHAPTER V

RESULTS AND DISCUSSION

The principal procedure used for data processing was a correlational analysis, which determined the relative contribution made by each of the independent variables (auditory perception, visual perception, and intelligence quotient) in predicting the dependent variable (reading). The correlation was used to determine the relationship between auditory and visual perception. The correlation was computed in order to determine the relationship when considering the best combination of all auditory perceptual variables and all visual perceptual variables. However, before the data were so treated, reliability of each of the tests established by a random re-sampling of part of the population of two thousand. This was done by equivalent form testing and equivalent task analysis. The results of this sample re-testing was significiant at the .001 level.

Statistically now significant correlations between the perceptual variables of auditory perception and visual perception gave supportive evidence that the variables of auditory and visual perception as was being analyzed in this research were not showing a significant relationship and were not substantially related. The correlation was computed in order to determine the residual relationship between auditory and visual perception.

The results of this treatment revealed a partial correlation coefficient of .21 between the auditory and visual perceptual measures.

The square of this partial correlation gave an estimate of four per cent common variance between the perceptual spheres. Thus, it can be stated that the data conform so that the hypothesis can be tested. (auditory and visual perception are not substantially related abilities.)

Table VII shows the interaction between the subjects mode of learning, that is auditory, visual or random, and the method of classroom the subject was exposed to for the nine months in first grade. That is whether the subject attended an Initial Teaching Alphabet Program or the Ginn 360 Basal Program. This table is a mean score of the reading achievement grades of both the high intelligence quotient students and the low intelligence quotient students by mode of learner associated with method of exposure. Therefore, each mean score is based on a sample of twenty four subjects.

The results of this interaction revealed the following information. The auditory learners exposed to the auditory method for nine months had a mean reading achievement score of 2.0. The auditory learners exposed to the visual method classroom for nine months had a mean reading achievement score of 2.4. The significance of this difference will be discussed under the analysis of variance in discussing the significance of the hypothesis. The visual learners exposed to the auditory method classroom for nine months had a mean reading achievement score of 2.4. The visual learners exposed to the visual method classroom had a mean reading achievement score of 2.0. The random learners exposed to the auditory method classroom for nine months had a mean achievement reading score of 2.3.

The analysis of variance and its significance for all of these findings will be discussed under the analysis of variance and their significances with the hypothesis of this dissertation.

TABLE VII

INTERACTION BETWEEN MODE OF LEARNING AND CLASSROOM METHOD

Mode of Learning	Classroom Method	Mean Reading Achievement Score (After Nine Months of First Grade Instruction)
Auditory	Auditory	2.0
Auditory	Visual	2.4
Visual	Auditory	2.4
Visual	Visual	2.0
Random	Auditory	2.3
Random	Visual	2.3

This table gives the mean reading achievement score as measured by the Metropolitan Achievement Test - reading sub-test after the subjects have been exposed to either the Initial Teaching Alphabet or Ginn 360 Basal Series for nine months in their first grade classrooms.

The correlational-values and their relationships for all five hundred and forty students are included in Appendices A, B, and C of this dissertation. They were needed for this dissertation to determine the relationship when considering the best combination on all perceptual variables. They also were needed in screening the sample population of five hundred and forty subjects to the sample tested on the hypothesis of one hundred and forty four subjects.

Statistics Discussed

The hypotheses of this dissertation were coded for both the analysis of variance (BIOMED DMDOVZ) and the analysis of covariance (BIOMED BMDOVZ) programs. They were programed at the University of Illinois Computer Center, Health Science computing facility, of the University of Los Angeles, California. The relative contribution made by each of the independent variables (auditory perception, visual perception, and intelligence quotient) in predicting the dependent variable (reading achievement) was determined with an analysis of variance technique which was subject to the F ratio for level of significance. The results of these findings are now discussed under the section of this chapter "Null Hypothesis Discussed".

Null Hypothesis Discussed

Hypothesis one stated that there is no practical pedagogical advantage in the efficiency of the teaching-learning process to match children according to their individual proclivities (auditory or visual) within the appropriate mode of instruction.

Table VIII shows that there was an interaction between mode of learning and method of classroom instruction. The mean square was 1.15 with a residual error of .16 which proved there was a relationship significant at the .01 level between individual proclivities (auditory and visual) and appropriate mode of instruction. This was an inverse relationship, however, and showed that the significance was in matching auditory proclivity with a visual method and visual proclivity with an auditory method.

The reason for this inverse relationship of significance greater than the .01 level was felt to be related to the process of reading itself. It was evident that reading is an associative process of both proclivities (auditory and visual) and that by exposing subjects to a strong method that would teach to their weakness and utilize their strength that the greatest reading achievement scores would be achieved. The research as discussed under the chapters "Related Research" alluded to this assumption but did not set up a design to test this hypothesis.

Table IX also verifies that this inverse relationship still exists at the .01 level of significance by controling the variable of high intelligence versus low intelligence.

TABLE VIII

ANALYSIS OF VARIANCE TABLE

(BIOMED BMDOVZ)

Source of Variation	Sums of Squares	Degrees of Freedom	Mean Square	F Ratio	Hypothesis
Hypothesis 2 & 5	.35	2	.17	1.06	Accepted
Hypothesis 4	22.50	3	7.50	46.87	Rejected .001 level
Hypothesis 3	.04	1	.04	.25	Accepted
Hypothesis 1	2.31	2	1.15	7.19	Rejected .01 level
Residual Error	20.47	132	.16[174]		Accepted

This table shows the analysis of variance and the levels of significance if present in testing hypothesis one, two, three, four and five. The analysis of variance was done on the BIOMED BMDOVZ Program at the University of Illinois Computer Center, an extension of the Health Science Computing facility of the University of Los Angeles.

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[174]Residual error, the error remaining after all other factors are accounted for).

TABLE IX

INTERACTION AMONG MODE OF LEARNING, INTELLIGENCE, METHOD OF INSTRUCTION AND READING ACHIEVEMENT

Mode of Learner	Intelligence Quotient of Learner	Method of Instruction	Mean Reading Achievement Score
Auditory	High Intelligence	Auditory	2.44166
Auditory	High Intelligence	Visual	2.87500
Auditory	Low Intelligence	Auditory	1.67500
Auditory	Low Intelligence	Visual	1.75000
Visual	High Intelligence	Auditory	2.56666
Visual	High Intelligence	Visual	2.31666
Visual	Low Intelligence	Auditory	2.10000
Visual	Low Intelligence	Visual	1.62500
Random	High Intelligence	Auditory	2.74166
Random	High Intelligence	Visual	2.60000
Random	Low Intelligence	Auditory	1.79166
Random	Low Intelligence	Visual	1.94166

This table shows the interaction between mode of learning and method of instruction with the new reading achievement score as measured by the Metropolitan Achievement Test - reading sub-test when controling the variable of high intelligence quotient versus low intelligence quotient. There were twelve usuable children in each of the twelve categories as measured by mode of learner paired with method of instruction.

The second hypothesis studied the effect of learning styles. The learners were auditory, visual, or random learners. The hypothesis studied if the style was controled then the environment makes no difference. To test this hypothesis the research controled the learning style of the sample. The learning style was controled by task analysis in that all learners to be placed in the sample were able to do ninety percent or better those tasks required of them in their various learning styles. The auditory learners, to be auditory learners passed all auditory tasks at the ninetieth percentile or higher. The visual learners, to be visual learners passed all visual tasks at the ninetieth percentile or higher. The random learners, to be random learners, passed all auditory and all visual tasks at the ninetieth percentile or higher. Also the environment was controled by dividing the sample randomly in half for each learning style. One half of the sample was exposed to the Initial Teaching Alphabet for nine months and the other half was exposed to the Ginn 360 Series.

The hypothesis then was: students whose learning styles are either auditory or visual will read at the same level in a given environment. This hypothesis was accepted. Table VIII showed the mean square to be .17 with a residual error of .16. This gave an F ratio of 1.06. When there are only two degrees of freedom with a sample of one hundred and forty four the results are not significant at the .01 level. Thus, the null hypothesis was accepted.

In Table VII this was also further illustrated for the random learners whose learning style was high in both the auditory and the visual modalities. This table showed that the random learners when exposed to the auditory

method classrooms, that is the Initial Teaching Alphabet classrooms, had a new reading achievement score after nine months in the first grade of 2.3. This table also showed that the random learners when exposed to the visual method classrooms, that is the Ginn 360 Series classrooms, had a mean reading achievement score after nine months in the first grade of 2.3. These mean scores show no significance at any level.

The third hypothesis was concerned with studying first grade reading achievement scores after the students had been instructed for nine months. This hypothesis tested the theory that one particular method of instruction was more effective on its students than another method if other important variables were held constant. The other variables that were held constant were: learning style, intelligence quotient, and methods themselves. The learning style was held constant by the learners having definite styles, that is they were either auditory or visual learners or random learners. The intelligence quotient was held constant in that the sample used was paired for high intelligence quotient, over one hundred and ten; and low intelligence quotient, under ninety but over seventy nine. Also the method was controled in that only two methods were studied and compared. The one method was the Initial Teaching Alphabet, the other was the Ginn 360 Series.

The hypothesis was: first grade reading achievement is not related to the instructional program used to teach reading. Table VIII showed the mean square to be .04 with a residual error of .16. There was only one degree of freedom which gave an F ratio of .25. This ratio is not significant at the .01 level. The null hypothesis was accepted.

The fourth hypothesis studied the relationship of reading achievement to intelligence. Reading achievement was measured after nine months of instruction. Reading achievement was measured by the Metropolitan Achievement Test - reading subtest. Intelligence quotient was measured by the Lorge-Thorndike Intelligence Test, Primary Battery Level I.

The fourth hypothesis was: first grade reading achievement is not related to intelligence, as measured by instruments in this dissertation. Table VIII showed the sums of squares to be 22.50 with three degrees of freedom. The mean square was 7.50 with a residual error of .16. This gave an F ratio of 46.87 which rejected the null hypothesis at the .001 level.

The significance of intelligence on reading is also verified in Table X which showed a variance between high and low intelligence. The mean reading achievement score for the high intelligence quotients was 2.59. The mean reading achievement score for the low intelligence quotients was 1.81.

The variable, mode of learner, matched with mean reading achievement scores was based on three separate samples of forty eight subjects. This variable was broken down into auditory, visual, and random learners.

The variable, of intelligence quotient, was based on two samples of seventy seven subjects each. This variable was broken down into the categories of high intelligence quotient and low intelligence quotient.

The significance of intelligence as a variable was significant beyond the .001 level by the achievement scores as measured by the Metropolitan Achievement Test - reading subtest.

TABLE X

INTERACTION BETWEEN HIGH AND LOW INTELLIGENCE AND MEAN READING SCORES

Variables	Categories	Mean Reading Achievement Scores
Mode of Learner	Auditory	2.18541
	Visual	2.15208
	Random	2.26875
Intelligence Quotient	High Intelligence	2.59027
	Low Intelligence	1.81389
Classroom Method	Auditory Method	2.21944
	Visual Method	2.18472

This table shows that the mean reading achievement scores are not significantly different except when controling for high intelligence quotients and low intelligence quotients between the subjects.

The fifth hypothesis was a study of modality development. The modality through which a learner holds expertise was held constant. The learners were catagorized as being auditory, visual, or random learners. When the modality was held constant this hypothesis tested the effect of this development in being a predictor of reading success after nine months of exposure. The learners that should have achieved should have been the ones analyzed as being more developed in the modality matched with an appropriate method. The learners that should have excelled should be those that were more fully developed in that modality.

The fifth hypothesis was: modality development does not predict reading success. Table VIII showed the sum of squares to be .35 for this hypothesis with two degrees of freedom. There was a mean square of .17 which gave an F Ratio of 1.06. This meant with two degrees of freedom the null hypothesis was accepted. The F Ratio was not anywhere near the .01 level of significance.

Also Table X showed that when the variable of mode of learner was held constant the catagories of auditory, visual, and random learner were not significantly different in the mean reading achievement scores. The mean reading achievement scores for auditory learners after nine months of instruction was 2.19. The mean reading achievement scores for visual learning after nine months of instruction was 2.15. The mean reading achievement scores for random learners after nine months of instruction was 2.27. These mean reading achievement scores are not significantly different at any acceptable level of statistical significance.

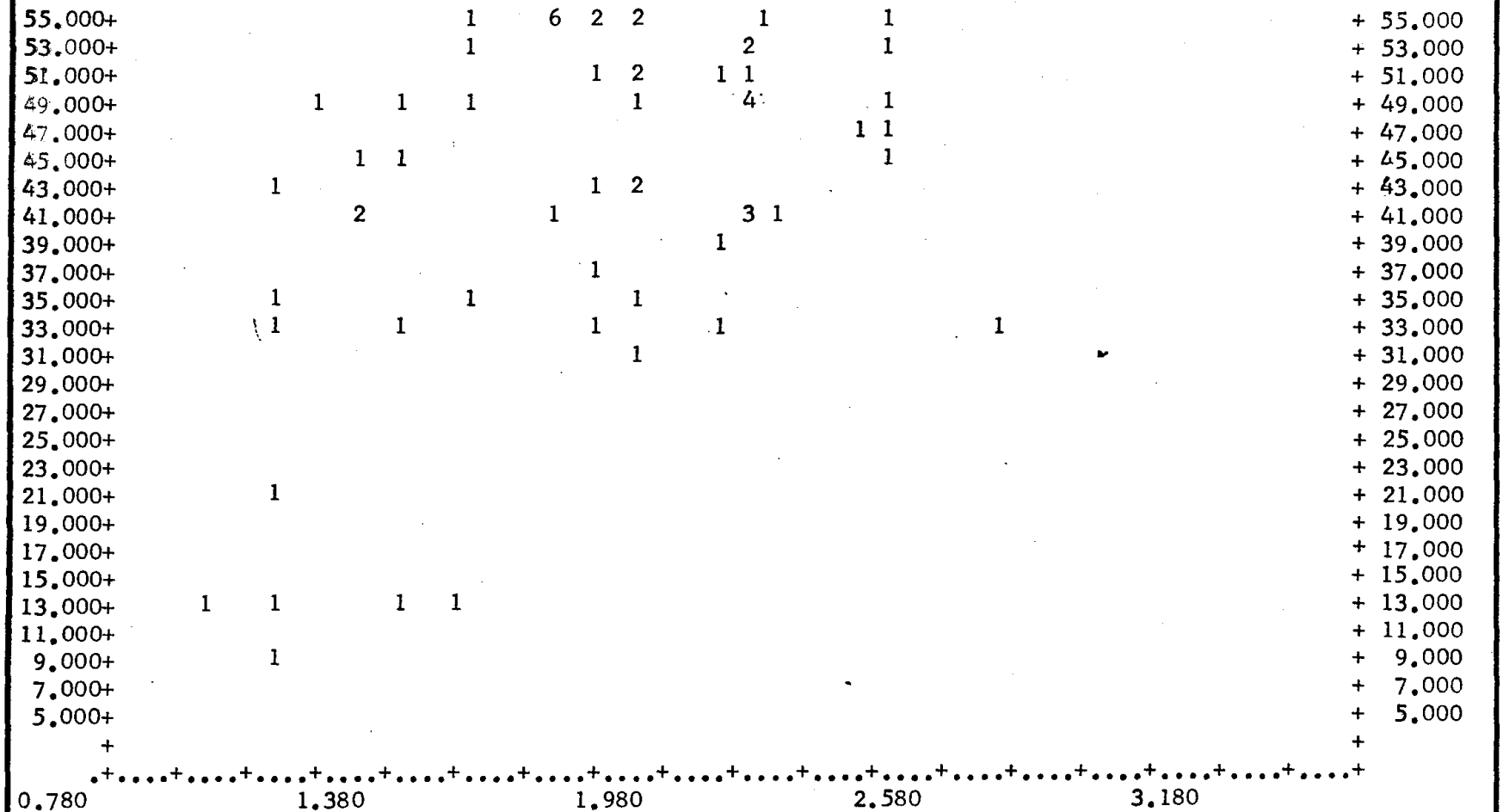
TABLE XI

RELATIONSHIP BETWEEN READING READINESS TEST AND READING ACHIEVEMENT TEST - ILLUSTRATION I

Variable 2*

Variable 1*

Variable 2*	0.780	1.080	1.380	1.680	1.980	2.280	2.580	2.880	3.180	3.480	Variable 2*
105.000											105.000
103.000											103.000
101.000											101.000
99.000			1		2	4 1 7	3 3 3 2	3 2 4	13	1	99.000
97.000						1 1 2		1	1		97.000
95.000				1	1 6	6 2 3	3 2	1			95.000
93.000				1 2	6	1 3		4	1	1	93.000
91.000				4 2	1 4	2 1		1	2		91.000
89.000		1	3	3 10	6 9	7 5	1 1	2 1	2		89.000
87.000	2	1		1 7	3 7	2 1 1	5	1 1	1		87.000
85.000		8	3	6 13	9 8	10 3	2	1	1		85.000
83.000	2	1	1	3 5	1 3	1 1					83.000
81.000	1	1	1	1 2	1 5	3 3					81.000
79.000	1	1	4	2 8	4 3	2 2 2	2 1	1 1			79.000
77.000	1		1	10 7	1	2 1					77.000
75.000			3	2	1	1					75.000
73.000	1	1	2	4	2 1	2 1	2				73.000
71.000	1			1 4	1 3	1 1	1	2			71.000
69.000		2	2	5 5	1 5	1	1				69.000
67.000		1	1	2	1	1					67.000
65.000	1	1	2	2	3						65.000
63.000		1	1		3	1					63.000
61.000	1	1	1	2 5	2 2	1 1 3	1				61.000
59.000				1	3						59.000
57.000					1	1					57.000
55.000		1	6	2 2		1 1					55.000
53.000		1			2	1					53.000



*Variable one is the Metropolitan Achievement - Test-Reading Sub-test. Variable two is the Metropolitan Reading Readiness Test Score.

This table shows the wide scatter in the relationship between the Metropolitan Readiness Test and the actual reading achievement scores made by the subjects after nine months in school as measured by the Metropolitan Achievement Test - sub-test reading. There was no predictable relationship that was

TABLE XII

RELATIONSHIP BETWEEN READING READINESS TEST AND READING ACHIEVEMENT TEST - ILLUSTRATION II

Variable 2 (Gates-McGintie Readiness Test)

Variable 1 (Metropolitan Achievement Test - reading sub-test)

	0.780	1.080	1.380	1.680	1.980	2.280	2.580	2.880	3.180	3.480	
102.000+											+102.000
100.000+					1		1	2 1 1	7		+100.000
98.000+						3 1 3	1 1		1 2		+ 98.000
96.000+						1 1 1	1 2	1	1	1	+ 96.000
94.000+				1		6 2 5	1 1 1	2 1 1 1	3 3		+ 94.000
92.000+					1 1 4 2	1	2 1	1	1		+ 92.000
90.000+				1	2	2 2 2 1	1		1		+ 90.000
88.000+				1 2	3 2 12 3	1	1 5		4		+ 88.000
86.000+				1	2 3 5 5	4	2 1	1	2	1	+ 86.000
84.000+			1	1 1	7 1 2 1		2 1		2		+ 84.000
82.000+			1	2 3	6 1 2 1	1 1	3	2 1	1		+ 82.000
80.000+				1	1 1 1	3					+ 80.000
78.000+		1 1 7		4 8	15 9 8 8	6	1 3		2		+ 78.000
76.000+		2 1			1 2 1	2 2					+ 76.000
74.000+				3 2	2	1					+ 74.000
72.000+				1 3	1 1 3 2	2 1	1				+ 72.000
70.000+				2 1	2 4 3	1 1	2 1 2				+ 70.000
68.000+			3	3 5	5 3 8 2		1				+ 68.000
66.000+					1 2						+ 66.000
64.000+					3 1 1 1	2					+ 64.000
62.000+			2 1	2 2	4 3 1	2					+ 62.000
60.000+			1	2 3	2 2	2					+ 60.000
58.000+		1	3		5 4 1	3	1				+ 58.000
56.000+				1							+ 56.000
54.000+			1	2 9	7 2 3 2						+ 54.000
52.000+		1 1		1 2	1 1 2 2		1				+ 52.000
50.000+			2 2	2	2 3 2 1	1 2	1				+ 50.000

TABLE XI

RELATIONSHIP BETWEEN READING READINESS TEST AND READING ACHIEVEMENT TEST - ILLUSTRATION I

Variable 2* Variable 1*

Variable 2*	0.780	1.080	1.380	1.680	1.980	2.280	2.580	2.880	3.180	3.480	Variable 2*
105.000											105.000
103.000											103.000
101.000											101.000
99.000				1		2 4 1	7 3 3 3 2	3 2 4	13	1	99.000
97.000						1 1	2		1	1	97.000
95.000					1 1 6	6 2	3 3 2		1		95.000
93.000					1 2	6 1	3		4	1	93.000
91.000					4 2 1	4 2	1		1 2		91.000
89.000			1 3		3 10 6	9 7	5 1 1	2 1	2		89.000
87.000		2 1			1 7 3	7 2 1	1 5	1	1 1		87.000
85.000			8 3		6 13 9	8 10	3 2 1		1		85.000
83.000	2		1 1		3 5 1	3 1	1				83.000
81.000		1 1 1			1 2 1	5 3	3				81.000
79.000		1 1 4			2 8 4	3 2 2	2 2 1	1 1			79.000
77.000	1		1		10 7	1 2 1					77.000
75.000			3		2	1 1					75.000
73.000		1 1 2			4 2	1 2	1 2				73.000
71.000	1				1 4 1	3 1 1	1	2			71.000
69.000		2 2			5 5 1	5 1	1				69.000
67.000		1 1			2	1 1					67.000
65.000	1	1 2			2	3					65.000
63.000		1 1				3	1				63.000
61.000	1	1 1			2 5 2	2 1 1	3 1				61.000
59.000					1 3						59.000
57.000						1	1				57.000
55.000		1 6			2 2	1	1				55.000
53.000		1			2		1				53.000

not predict reading success was accepted based on the two readiness tests used in this dissertation.

CHAPTER VI

CONCLUSIONS AND SUMMARY

It should prove helpful to summarize the purposes and results embodied in this study. The aims with which this research set out may be stated quite simply under three general heads. These aims were: first, that auditory and visual perception showed virtual independence of each other. Since they seem to be independent functions according to this study, it is particularly important to consider modalities separately in primary-grade instruction.

Second, the determination that differential perceptual abilities exist among children and determination of how these abilities relate to achievement can be measured at the first-grade level, with group testing devices, especially significant for educational planning. Having the capability of identifying, diagnosing, or assessing any type of learning pattern based on development, intelligence, or perceptual variables at the crucial age of a first-grade child, seems to be very important for instructional, curricular and diagnostic purpose. There should be little quarrel with the contention that perceptual modalities of children at a first-grade level ought to be taken into consideration so that they might begin their education with every advantage, in order to guarantee development of favorable attitudes and learning patterns, and thus, guarantee maximum development of individual potentialities. Even though the data revealed a significant relationship between individual proclivities (audi-

tory and visual) and appropriate mode of instruction that was an inverse relationship, that did not mean that perceptual abilities does not relate to reading achievement. The contrary was felt to be revealed by the research. An important interpretation of this result was needed. The conclusion made from this was that the important criteria to be met by the subject in learning to read was not just the identification of the proclivity through which the subject best learns but the subjects exposure to a method that integrates his mode of learning, reinforcing it as a strength while teaching to subjects weaker proclivity and not ignoring it. This research concluded that reading, being a dynamic process, was learned not only through proper percepts but through strong associations which the subject was able to establish integrating the auditory and visual modalities, by exposing a learner who was strong in the auditory modalities, for example, to a visual method, and by exposing a visual learner to a strong auditory method, the optimum learning environment than existed.

Third, the how of teaching of reading was not the concern of this study but the findings suggest that the acquisition of reading was to a significant extent, dependent on certain (not yet fully determined) requisite levels of auditory and visual perceptual development and the exposure then of these students to materials that stressed heavily the modality of their weakness. The combination of these factors seemed to produce the best conditions for high reading results.

The data strongly suggested that it was possible to identify potentiality for reading achievement at the beginning of first grade with group

administered, perceptual tests. This means that research should be able to identify target children and develop appropriate intervention in order to maximize early learning.

There was some evidence from other studies that optimal perceptual development occurs by the time a child is eight years of age; and similarly, evidence that remediation of maladaptation and reading problems was far more difficult to achieve after eight or nine years of age. There was also theoretical and empirical evidence suggesting that there were optimal periods to intervene in order to influence development of all human characterization.

Only recently researchers have begun to look for the source of reading problems--but not too effectively. Perhaps we are asking the wrong questions or approaching the problem from the wrong perspective. We would not expect to learn much that is useful about epidemiology of infections if we studied the distribution of fever in a population without regard to its source. Yet this has been the common practice in respect to reading. Another way of looking at what has happened in the field is analogous to an old cornish custom for social insanity. The custom simply involved placing the person before a water spigot, with water running into a bucket, giving him a ladel, and telling him not to let the water overflow. The person was deemed "socially insane" if he did not attempt to cut-off the source of water. It seems that the field of reading might not pass the test.

Reading problems are diagnosed in clinics and schools which then set-up reading programs as though reading were a uni-factor skill. The result

is that reading programs were established with a phonics or sight and say emphasis; a practice which seems to be based on a tacit, or explicit, assumption that poor readers are a homogeneous group. Moreover, children were identified, looked at, or tested after the fact; viz., when the child has grown too old to effect adequate remediation. Stated more precisely, we do not study young children to determine precursors to reading.

At the risk of throwing out the proverbial baby with the bath water, it might be suggested that we abandon existing methods. That is, stop the ineffective "labeling", and develop screening methods that will identify requisite perceptual and task factors at an early age.

Screening instruments should be geared to early assessment, preferably group administered, in order to determine the incidence and prevalence of children who are at high risk for reading disabilities so that we can work toward prevention. This proposition is made with the understanding that we should not minimize the importance of the rigors of individual assessment, treatment or remediation, but rather as an attempt to broaden the application of research.

The consistency and magnitude of the results suggest that there is an underlying relationship between learning variables and reading achievement and perhaps that perceptual factors are requisites for learning to read. Again note, research shows the relationship between the learning modalities and reading achievement tends to increase through the third grade level because the tasks tend to be more closely related to verbal learning as a child approaches eight or nine years of age. This has been proposed by

others (as stated in a review of the research) and is based on the premise that higher level thought processes begin to dominate cognitive functions of children at about eight years of age with perceptual variables becoming less important at that age level and beyond. We cannot overlook the finding, however, that maintains the high level of correlation with the verbal achievement measures are consistently higher correlations than intelligence quotient is held constant.

The data strongly suggest that we are able to identify potentiality for reading achievement at the beginning of first grade with group administered, and individual administered perceptual tests. This means that we should be able to identify target children, and develop appropriate intervention.

This exploration was intended to be a first step to evaluate visual and auditory (and ultimately tactile-kinesthetic) perceptual development of children, in order to determine the minimum perceptual requisites for acquisition of beginning reading skills, to assess the type of instruction most appropriate for children having particular perceptual patterns, and to develop group screening tests to make such assessment possible.

The efficacy of teaching toward a strong learning propensity, or teaching toward a weak area in order to develop that area to an adequate level and to maximize the ability to learn beginning reading needs additional research. This study was only a beginning down the road to more fully understanding the dynamics of a "simple" task, that of learning to read.

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APPENDIX A

Correlation with Transgeneration of Thirty-Six Variables that are Task Analyzed to Determine Auditory, Visual and Random Learners

The variables that were controled and coded are as follows:

1. Metropolitan Achievement

   Test-Reading Subtest

2. Intelligence Test - Lorge-Thorndike Intelligence Test

   Primary Battery Level I

3. Modality through which the subject shows strength. By this the dissertation has signified that the learner is:

   A. An auditory learner - successfully completing ninety per cent of all auditory tasks

   B. A visual learner - successfully completing ninety per cent of all visual tasks.

   C. A random learner - successfully completing ninety per cent of all auditory and visual tasks.

4. Metropolitan Readiness Test - This score was recorded in percentile figures.

5. Gates-McGintie Test - This score was recorded in percentile figures.

6. Slingerland - First Grade Screening Test

   Visual Discrimination of Letter Forms

7. Slingerland - First Grade Screening Test

   Visual Knowledge of the Alphabet

8. University of California at Los Angeles

   Visual Discrimination Inventory

9. Slingerland - First Grade Screening Test

   Analysis of Visual Reversals

10. Slingerland - First Grade Screening Test

    Visual Analysis of Inversions

11. Slingerland - First Grade Screening Test

    Visual Analysis of Whole Word Attack Skills

12. Slingerland - First Grade Screening Test

    Visual Analysis of Picture Completion Skills

13. Slingerland - First Grade Screening Test

    Visual Analysis of Visual Memory Skills

14. Developmental Test of Visual Motor Integration

15. Slingerland - First Grade Screening Test

    Visual Analysis of Matching Skills

16. Slingerland - First Grade Screening Test

    Visual Analysis of Copying Skills

17. Developmental Test of Visual Perception

18. Slingerland - First Grade Screening Test

    Compilation of all Visual Tasks

19. Des Plaines Kindergarten Test

    Purdue Perceptional Motor Survey

    Perceptual Survey Rating Scale

20. Des Plaines Kindergarten Test
    Visual Discrimination Test
21. Des Plaines Kindergarten Test
    Visual Memory Test
22. Des Plaines Kindergarten Test
    Spatial Relationship Tasks
23. Des Plaines Kindergarten Test
    Figure Ground Task
24. Des Plaines Kindergarten Test
    Enclosure Ability
25. Des Plaines Kindergarten Test
    Gross Motor Tasks
26. Des Plaines Kindergarten Test
    Fine Motor Tasks
27. Slingerland - First Grade Screening Test
28. Gates-McGintie Readiness Test
    Auditory Word Meaning Tasks
29. Gates-McGintie Readiness Test
    Auditory Listening Test
30. Gates-McGintie Readiness Test
    Auditory Sound Blending Test
31. Gates-McGintie Readiness Test
    Following Directions Tasks

32. Non Verbal Auditory Discrimination Tasks

33. Slingerland- First Grade Screening Tasks

    Tasks Analysis all Items

34. Illinois Tests of Psycholinguistic Abilities

    All Auditory Tasks

35. Illinois Tests of Psycholinguistic Abilities

    All Visual Tasks

36. Wepman Auditory Discrimination Tasks

UNIVERSITY OF ILLINOIS COMPUTER CENTER

BMD02D Correlation with Transgeneration - Revised May 5, 1969

Health Sciences computing facility, UCLA

Problem Code Cates

Number of Variables 36

Number of Cases 540

Variable Format Card(S)

(F3.1,F4.0,F2.0,2F3.0,1X,31F1.0)

Remaining Sample Size= 540

Sums

1148.4575	55308.0000	1080.0000	42128.0000	38554.0000	450.0000	443.0000	347.0000
395.0000	429.0000	436.0000	486.0000	454.0000	538.0000	479.0000	439.0000
490.0000	494.0000	538.0000	451.0000	480.0000	514.0000	508.0000	516.0000
539.0000	502.0000	398.0000	380.0000	390.0000	377.0000	403.0000	456.0000
453.0000	369.0000	373.0000	410.0000				

Means

2.1268	102.4222	2.0000	78.0148	71.3963	0.83333	0.8204	0.6426
0.7315	0.7944	0.8074	0.9000	0.8407	0.9963	0.8870	0.8130

	0.9074	0.9148	0.9963	0.8352	0.8889	0.9510	0.9407	0.9556
	0.9981	0.9296	0.7370	0.7037	0.7222	0.6981	0.7463	0.8444
	0.8389	0.6833	0.6907	0.7593				

Cross Product Deviations

Row	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
1	109.8955	1747.3174	36.7993	1944.9775	2194.5410	21.4156	25.4037	31.1818
2	1747.3174	109054.1250	138.9815	38522.6992	48737.7148	243.9968	282.9458	456.4478
3	36.7993	138.9815	359.9873	2529.9534	2679.9587	71.9970	10.9983	52.9968
4	1944.9775	38522.6992	2529.9534	150155.6875	134796.8125	1073.2761	815.3804	1155.8064
5	2194.5410	48737.7148	2679.9587	134796.8125	191330.6875	869.6240	768.3867	1292.4380
6	21.4156	243.9968	71.9970	1073.2761	869.6240	74.9964	29.8305	38.8304
7	25.4037	282.9458	10.9983	815.3804	768.3867	29.8305	79.5722	42.3288
8	31.1818	456.4478	52.9968	1155.8064	1292.4380	38.8304	42.3288	124.0170
9	21.8921	194.2194	18.9989	1102.0913	1289.4097	27.8325	38.9515	65.1729
10	15.6797	187.8632	22.9991	1071.5896	1293.9338	19.4993	32.0592	45.3249
11	14.0902	182.9080	67.9985	889.4861	1029.1619	28.6660	14.3178	47.8271
12	9.4511	85.7974	53.9973	818.7437	787.3435	19.9994	21.2991	20.6974

13	12.4081	133.3080	85.9972	769.2175	751.0291	28.6649	16.5501	33.2600
14	0.1536	3.8444	2.0000	-7.9704	0.7926	-0.3333	0.6407	0.2852
15	13.1388	240.7521	60.9973	864.8501	849.1250	28.8325	18.0419	30.1952
16	13.3147	252.6413	96.9968	1231.4404	1113.9768	36.1639	21.8546	38.8989
17	7.8414	128.1083	49.9978	688.6843	583.7688	24.6659	16.0179	16.1294
18	10.6346	179.4190	37.9983	672.6255	587.1863	24.3326	14.7368	15.5590
19	0.2536	-4.1556	2.0000	-5.9703	-7.2074	-0.3333	0.6407	0.2852
20	14.4889	246.5744	57.9980	887.2595	968.2158	23.1660	12.0127	34.1882
21	13.0100	213.3296	59.9975	680.8333	529.7314	18.9995	13.2220	20.5551
22	6.8987	26.9753	25.9980	634.3306	526.2505	16.6662	16.3292	10.7072
23	9.5602	126.5079	30.9975	845.4175	694.6287	17.6663	15.2516	17.5625
24	8.1455	75.1304	23.9977	684.2998	546.4592	12.9998	14.6886	14.4220
25	0.6269	10.4220	0.9999	65.0113	47.3931	0.8333	0.8204	0.6426
26	4.4228	138.0415	29.9974	744.5112	590.0071	11.6664	12.1738	13.4183
27	26.1100	136.9536	-10.9998	677.0601	897.2297	-22.6658	-15.5068	-40.7493
28	26.9952	263.5432	-5.0003	731.3396	1197.3596	-20.6660	-12.7405	-40.1822
29	22.9283	257.3223	-16.9993	1194.1814	1567.3943	-13.9998	-3.9444	-23.6091
30	15.2783	88.8220	9.9990	928.3826	1263.5593	-20.1661	-21.2784	-47.2543

31	3.3817	140.8427	4.9994	671.0093	1032.2615	-19.8322	-21.6076	-44.9617
32	-9.5396	40.4647	0.9997	305.2292	621.2573	-13.9991	-14.0879	-29.0193
33	-8.8588	-6.2671	3.9996	358.2705	643.4473	-12.4993	-13.6270	-28.0915
34	-12.6088	-184.7960	80.9994	-5.4657	381.7356	1.5013	-22.7143	-15.1138
35	38.5818	208.5079	72.9968	1490.4185	1354.1338	15.1638	12.0000	-2.6891
36	21.0884	54.8902	-0.0002	715.8931	867.4851	-21.6660	-23.3508	-46.4600

Row	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16
1	21.8921	15.6797	14.0902	9.4511	12.4081	0.1536	13.1388	13.3147
2	194.2194	187.8632	182.9080	85.7974	133.3080	3.8444	240.7521	252.6413
3	18.9989	22.9991	67.9985	53.9973	85.9972	2.0000	60.9973	96.9968
4	1102.0913	1071.5896	889.4861	818.7437	769.2175	-7.9704	864.8501	1231.4404
5	1289.4097	1293.9338	1029.1619	787.3435	751.0291	0.7926	849.1250	1113.9768
6	27.8325	19.4993	28.6660	19.9994	28.6649	-0.3333	28.8325	36.1639
7	38.9515	32.0592	14.3178	21.2991	16.5501	0.6407	18.0419	21.8546
8	65.1729	45.3249	47.8271	20.6974	33.2600	0.2852	30.1952	38.8989
9	106.0610	75.1911	33.0707	22.4991	24.9065	1.4630	17.6199	26.8779

10	75.1911	88.1797	36.6197	22.8991	22.3214	0.5889	17.4607	24.2381
11	33.0717	36.6197	83.9667	22.5992	35.4362	0.6148	28.2506	26.5473
12	22.4991	22.8991	22.5992	48.5963	21.3993	1.8000	26.8977	28.8975
13	24.9065	22.3214	35.4362	21.3993	72.3004	-0.3185	27.2835	32.9121
14	1.4630	0. 5889	0.6148	1.8000	-0.3185	1.9926	0.7741	-0.3741
15	17.6199	17.4607	28.2506	26.8977	27.2835	0.7741	54.1056	40.5880
16	26.8779	24.2381	26.5473	28.8975	32.9121	-0.3741	40.5880	82.1055
17	22.5734	25.7215	26.3697	18.9996	27.0363	-0.1852	20.3513	27.6473
18	18.6476	16.5441	22.1403	12.3998	18.6737	-0.1704	15.8035	16.3959
19	0.4630	0.5889	0.6148	0.8000	0.6815	0.9926	0.7741	-0.3741
20	29.0994	27.7031	33.8578	19.0994	40.8234	1.6704	25.9446	20.3524
21	13.8887	17.6662	23.4439	14.9998	36.4432	-0.2222	19.2216	22.7770
22	13.0183	14.6553	15.9921	17.3995	15.8589	-0.0963	17.0625	16.1367
23	9.4072	11.4220	17.8366	15.7997	17.9033	-0.1185	21.3823	18.0137
24	12.5553	13.0664	14.3775	14.5998	13.1775	-0.0889	18.2874	15.5109
25	0.7315	0.7944	0.8074	0.9000	0.8407	-0.0037	0.8870	0.8130
26	7.7961	8.1887	5.6812	13.1997	10.9479	-0.1407	12.7072	18.8903
27	-28.1285	-23.1879	-26.3475	-13.1998	-31.6144	-0.5259	-15.0405	-24.5582

28	-30.9609	-25.8875	-28.8141	-10.9998	-23.4810	-0.5926	-13.0739	-22.9247
29	-10.2776	-8.8332	-18.8885	-10.9998	-17.8886	-0.5556	-10.9443	-21.0540
30	-35.7661	-26.5042	-25.3921	-8.2998	-19.9589	-0.6037	-10.4128	-22.4854
31	-33.7844	-25.1587	-24.3846	-11.6998	-19.8181	-0.5074	-11.4758	-21.6219
32	-22.5527	-17.2647	-15.1776	-8.3998	-12.3776	-0.3111	-8.4887	-14.7096
33	-22.3583	-17.8812	-14.7554	-5.6998	-10.8554	-0.3222	-5.8276	-13.2709
34	-13.9142	-9.1484	24.0667	-1.0997	19.7669	0.3667	1.6838	-3.9814
35	-2.8432	2.6717	-6.1632	16.2973	10.4009	0.3815	14.1326	24.7618
36	-34.9061	-26.7210	-25.0364	-12.9998	-20.7033	-0.4815	-14.6850	-24.3137

Row	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21	Col. 22	Col. 23	Col. 24
1	7.8414	10.6346	0.2536	14.4889	13.0100	6.8987	9.5602	8.1455
2	128.1083	179.4190	-4.1556	246.5744	213.3296	26.9753	126.5079	75.1304
3	49.9978	37.9983	2.0000	57.9980	59.9975	25.9980	30.9975	23.9977
4	688.6843	672.6255	-5.9703	887.2595	680.8333	634.3306	845.4175	684.2998
5	583.7688	587.1863	-7.2074	968.2158	529.7314	526.2505	694.6287	546.4592
6	24.6659	24.3336	-0.3333	23.1660	18.9995	16.6662	17.6663	12.9998

7	16.0179	14.7368	0.6407	12.0127	13.2220	16.3292	15.2516	14.6886
8.	16.1294	15.5590	0.2852	34.1882	20.5551	10.7072	17.5625	14.4220
9	22.5734	18.6476	0.4630	29.0994	13.8887	13.0183	9.4072	12.5553
10	25.7215	16.5441	0.5889	27.7031	17.6662	14.6553	11.4220	13.0664
11	26.3697	22.1403	0.6148	33.8578	23.4439	15.9921	17.8366	14.3775
12	18.9996	12.3998	0.8000	19.0994	14.9998	17.3995	15.7997	14.5998
13	27.0363	18.6737	0.6815	40.8234	36.4432	15.8589	17.9033	13.1775
14	-0.1852	-0.1704	0.9926	1.6704	-0.2222	-0.0963	-0.1185	-0.0889
15	20.3513	15.8035	0.7741	25.9446	19.2216	17.0625	21.3823	18.2874
16	27.6473	16.3959	-0.3741	20.3524	22.7770	16.1367	18.0137	15.5109
17	45.3683	27.7399	-0.1852	17.7589	21.4440	16.5921	13.0368	12.7775
18	27.7399	42.0786	-0.1704	14.4183	17.8885	14.7849	13.2738	13.9553
19	-0.1852	-0.1704	1.9926	1.6704	-0.2222	-0.0963	-0.1185	-0.0889
20	17.7589	14.4183	1.6704	74.3277	26.1104	16.7143	17.7255	14.0442
21	21.4440	17.8885	0.2222	26.1104	53.3297	14.1109	16.4442	13.3331
22	16.5921	14.7849	-0.0963	16.7143	14.1109	24.7461	15.4590	15.8442
23	13.0368	13.2738	-0.1185	17.7255	16.4442	15.4590	30.1000	17.5772
24	12.7775	13.9553	-0.0889	14.0442	13.3331	15.8442	17.5772	22.9299

25	0.9074	0.9148	-0.0037	0.8352	0.8889	0.9518	0.9407	0.9555
26	7.4812	5.7627	-0.1407	8.7368	6.7776	11.1701	13.7479	12.3109
27	-12.1479	-11.0961	-0.5259	-20.4032	-14.7776	-5.8368	-6.4146	-5.3109
28	-11.8147	-10.6295	-0.5926	-21.3699	-13.7776	-3.7036	-4.4813	-4.1109
29	-10.8887	-7.7776	-0.5556	-14.7221	-10.6665	-4.2221	-1.8888	-2.6665
30	-11.0925	-9.8850	-0.6037	-19.8645	-13.1110	-3.8480	-0.6593	-0.2445
31	-10.6850	-9.6702	-0.5074	-17.5794	-12.2221	-4.5961	-2.1184	-3.0887
32	-6.7776	-6.1553	-0.3111	-12.8442	-8.3331	-3.0442	-3.9776	-2.7331
33	-7.0554	-6.4109	-0.3222	-11.3387	-7.6665	-3.1887	-1.1555	-1.8665
34	11.1668	6.4335	0.3667	12.8170	16.0001	-0.2332	-2.1331	-4.5998
35	7.5368	4.7738	0.3815	3.4747	6.4428	9.9590	12.1031	11.5775
36	-12.0368	-11.0739	-0.4815	-20.4255	-14.4442	-6.2591	-6.7035	-5.7776

Row	Col. 25	Col. 26	Col. 27	Col. 28	Col. 29	Col. 30	Col. 31	Col. 32
1	0.6269	4.4228	26.1100	26.9952	22.9283	15.2783	3.3317	-9.5396
2	10.4220	138.0415	136.9536	263.5432	257.3223	88.8220	140.8427	40.4647
3	0.9999	29.9974	-10.9998	-5.0003	-16.9993	9.9990	4.9994	0.9997

4	65.0113	744.5112	677.0601	731.3396	1194.1814	928.3826	671.0093	305.2292
5	47.3931	590.0071	897.2297	1197.3596	1567.3943	1263.5593	1032.2615	621.2573
6	0.8333	11.6664	-22.6658	-20.6660	-13.9998	-20.1661	-19.8322	-13.9991
7	0.8204	12.1738	-15.5068	-12.7405	-3.9444	-21.2784	-21.6076	-14.0879
8	0.6426	13.4183	-40.7493	-40.1822	-23.6091	-47.2543	-44.9617	-29.0193
9	0.7315	7.7961	-28.1285	-30.9609	-10.2776	-34.7661	-33.7844	-22.5527
10	0.7944	8.1887	-23.1879	-25.8875	-8.8332	-26.5042	-25.1587	-17.2647
11	0.8074	5.6812	-26.3475	-28.8141	-18.8885	-25.3921	-24.3846	-15.1776
12	0.9000	13.1997	-13.1998	-10.9998	-10.9998	-8.2998	-11.6998	-8.3998
13	0.8407	10.9479	-21.6144	-23.4810	-17.8886	-19.9589	-19.8181	-12.3776
14	-0.0037	-0.1407	-0.5259	-0.5926	-0.5556	-0.6037	-0.5074	-0.3111
15	0.8870	12.7072	-15.0405	-13.0739	-10.9443	-10.4128	-11.4758	-8.4887
16	0.8130	18.8903	-24.5582	-22.9247	-21.0540	-22.4854	-21.6219	-14.7096
17	0.9074	7.4812	-12.1479	-11.8147	-10.8887	-11.0925	-10.6850	-6.7776
18	0.9148	5.7627	-11.0961	-10.6295	-7.7776	-9.8850	-9.6702	-6.1553
19	-0.0037	-0.1407	-0.5259	-0.5296	-0.5556	-0.6037	-0.5074	-0.3111
20	0.8352	8.7368	-20.4032	-21.3699	-14.7221	-19.8645	-17.5794	-12.8442

21	0.8889	6.7776	-14.7776	-13.7776	-10.6665	-13.1110	-12.2221	-8.3331
22	0.9518	11.1701	-5.8368	-3.7036	-4.2221	-3.8480	-4.5961	-3.0442
23	0.9407	13.7479	-6.4146	-4.4813	-1.8888	-0.6593	-2.1184	-3.9776
24	0.9555	12.3109	-5.3109	-4.1109	-2.6665	-0.2445	-3.0887	-2.7331
25	0.9981	-0.0704	-0.2630	-0.2963	-0.2778	0.6981	-0.2537	-0.1555
26	-0.0704	35.3224	-5.9924	-8.2590	-2.5554	0.5297	-0.6406	1.0890
27	-0.2630	-5.9924	104.6561	79.9227	49.5525	67.1342	45.9714	12.9094
28	-0.2963	-8.2590	79.9227	112.5891	59.5525	74.7007	57.4043	25.1081
29	-0.2778	-2.5554	49.5525	59.5525	108.3298	55.7192	57.9413	29.6637
30	0.6981	0.5297	67.1342	74.7007	55.7192	113.7948	73.6431	47.6413
31	-0.2537	-0.6406	45.9714	57.4043	57.9413	73.6431	102.2390	60.6857
32	-0.1555	1.0890	12.9094	25.1081	29.6637	47.6413	60.6857	70.9301
33	-0.1611	2.8778	13.1206	25.2193	29.8303	48.7358	59.9246	69.4633
34	-0.3167	-6.0331	-1.9688	7.3306	12.4971	27.3803	40.6135	54.3969
35	0.6907	14.2469	43.0842	38.5177	18.6109	29.5909	13.6322	-19.9758
36	-0.2407	-6.1480	80.8117	72.4784	52.8859	66.7563	56.0155	20.774[illegible]

Row	Col. 25	Col. 26	Col. 27	Col. 28	Col. 29	Col. 30	Col. 31	Col. 32
1	0.6269	4.4228	26.1100	26.9952	22.9283	15.2783	3.3817	-9.5396
2	10.4220	138.0415	136.9536	263.5432	257.3223	88.8220	147.8427	40.4647
3	0.9999	29.9974	-10.9998	-5.0003	-16.9993	9.9990	4.9994	0.9997
4	75.0113	744.5112	677.0601	731.3396	1194.1814	928.3826	671.0093	305.2292
5	47.3931	590.0071	897.2297	1197.3596	1567.3948	1263.5593	1032.2615	621.2573
6	0.8333	11.6664	-22.6658	-20.6660	-13.9998	-20.1661	-19.8322	-13.9991
7	0.8204	12.1738	-15.5068	-12.7405	-3.9444	-21.2784	-21.6076	-14.0879
8	0.6426	13.4183	-40.7493	-40.1822	-23.6091	-47.2543	-44.9617	-29.0193
9	0.7315	7.7961	-28.1285	-30.9609	-10.2776	-35.7661	-33.7844	-22.5527
10	0.7944	8.1887	-23.1879	-25.8875	-8.8332	-26.5042	-25.1587	-17.2647
11	0.8074	5.6812	-26.3475	-28.8141	-18.8885	-25.3921	-24.3846	-15.1776
12	0.9000	13.1997	-13.1998	-10.9998	-10.9998	-8.2998	-11.6998	-8.3998
13	0.8407	10.9479	-21.6144	-23.4810	-17.8886	-19.9589	-19.8181	-12.3776
14	-0.0037	-0.1407	-0.5259	-0.5926	-0.5556	-0.6037	-0.5074	-0.3111
15	0.8870	12.7072	-15.0405	-13.0739	-10.9443	-10.4128	-11.4758	-8.4887
16	0.8130	18.8903	-24.5582	-22.9247	-21.0540	-22.4854	-21.6219	-14.7096

17	0.9074	7.4812	-12.1479	-11.8147	-10.8887	-11.0925	-10.6850	-6.7776
18	0.9148	5.7627	-11.0961	-10.6295	-7.7776	-9.8850	-9.6702	-6.1553
19	-0.0037	-0.1407	-0.5259	-0.5926	-0.5556	-0.6037	-0.5074	-0.3111
20	0.8352	8.7368	-20.4032	-21.3699	-14.7221	-19.8645	-17.5794	-12.8442
21	0.8889	6.7776	-14.7776	-13.7776	-10.6665	-13.1110	-12.2221	-8.3331
22	0.9518	11.1701	-5.8368	-3.7036	-4.2221	-3.8480	-4.5961	-3.0442
23	0.9407	13.7479	-6.4146	-4.4813	-1.8888	-0.6593	-2.1184	-3.9776
24	0.9555	12.3109	-5.3109	-4.1109	-2.6665	-0.2445	-3.0887	-2.7331
25	0.9981	-0.0704	-0.2630	-0.2963	-0.2778	0.6981	-0.2537	-0.1555
26	-0.0704	35.3224	-5.9924	-8.2590	2.5554	0.5297	-0.6406	1.0890
27	-0.2630	-5.9924	104.6561	79.9227	49.5525	67.1342	45.9714	12.9094
28	-0.2963	-8.2590	79.9227	112.5891	59.5525	74.7007	57.4043	25.1081
29	-0.2778	-2.5554	49.5525	59.5525	108.3298	55.7192	57.9413	29.6637
30	0.6981	0.5297	67.1342	74.7007	55.7192	113.7948	73.6431	47.6413
31	-0.2537	-0.6406	45.9714	57.4043	57.9413	73.6431	102.2390	60.6857
32	-0.1555	1.0890	12.9094	25.1081	29.6637	47.6413	60.6857	70.9301
33	-0.1611	2.8778	13.1206	25.2193	29.8303	48.7358	59.9246	69.4633
34	-0.3167	-6.0331	-1.9688	7.3306	12.4971	27.3803	40.6135	54.3969

35	0.6907	14.2469	43.0842	38.5177	18.6109	29.5909	13.6322	-19.9758
36	-0.2407	-0.1480	80.8117	72.4784	52.8859	66.7563	56.0155	20.7747

	Col. 33	Col. 34	Col. 35	Col. 36
1	-8.8588	-12.6088	38.5818	21.0884
2	-6.2671	-184.7960	208.5079	54.8902
3	3.9996	80.9994	72.9968	-0.0002
4	358.2705	-5.4657	1490.4185	715.8931
5	643.4473	381.7356	1354.1338	867.4851
6	-12.4993	1.5013	15.1638	-21.6660
7	-13.6270	-22.7143	12.0000	-23.3508
8	-28.0915	-15.1138	-2.6891	-46.4600
9	-22.3583	-13.9142	-2.8432	-34.9061
10	-17.8812	-9.1484	2.6717	-26.7210
11	-14.7554	24.0667	-6.1632	-25.0364
12	-5.6998	-1.0997	16.2973	-12.9998
13	-10.8554	19.7669	10.4009	-20.7033
	-0.3222	0.3667	0.3815	-0.4815

15	-5.8276	1.6838	14.1326	-14.6850
16	-13.2709	-3.9814	24.7618	-24.3137
17	-7.0554	11.1668	7.5368	-12.0368
18	-6.4109	6.4335	4.7738	-11.0739
19	-0.3222	0.3667	0.3815	-0.4815
20	-11.3387	12.8170	3.4747	-20.4255
21	-7.6665	16.0001	6.4428	-14.4442
22	-3.1887	-0.2332	9.9590	-6.2591
23	-1.1555	-2.1331	12.1031	-6.7035
24	-1.8665	-4.5998	11.5775	-5.7776
25	-0.1611	-0.3167	0.6907	-0.2407
26	2.8778	-6.0331	14.2469	-6.1480
27	13.1206	-1.9688	43.0842	80.8117
28	25.2193	7.3306	38.5177	72.4784
29	29.8303	12.4971	18.6109	52.8859
30	48.7358	27.3803	29.5909	66.7563
31	59.9246	40.6135	13.6322	56.0155
32	69.4633	54.3964	-19.9758	20.7747

33	72.9800	54.4469	-18.9037	19.0528
34	54.4469	116.8467	-47.8808	2.8309
35	-18.9037	-47.8808	115.3500	46.7953
36	19.0528	2.8309	46.7953	98.7004

APPENDIX B

Variance - Covariance Matrix of Thirty-Six Variables That are Task Analyzed to Determine Auditory, Visual, and Random Learners

The variables that were controled and coded are as follows:

1. Metropolitan Achievement
   Test-Reading Subtest
2. Intelligence Test - Lorge-Thorndike Intelligence Test
   Primary Battery Level I
3. Modality through which the subject shows strength. By this the dissertation has signified that the learner is:
   A. An auditory learner - successfully completing ninety per cent of all auditory tasks.
   B. A visual learner - successfully completing ninety per cent of all visual tasks.
   C. A random learner - successfully completing ninety per cent of all auditory and visual tasks.
4. Metropolitan Readiness Test - This score was recorded in percentile figures.
5. Gates-McGintie Test - This score was recorded in percentile figures.
6. Slingerland - First Grade Screening Test
   Visual Discrimination of Letter Forms
7. Slingerland - First Grade Screening Test
   Visual Knowledge of the Alphabet

8. University of California at Los Angeles

   Visual Discrimination Inventory

9. Slingerland - First Grade Screening Test

   Analysis of Visual Reversals

10. Slingerland - First Grade Screening Test

    Visual Analysis of Inversions

11. Slingerland - First Grade Screening Test

    Visual Analysis of Whole Word Attack Skills

12. Slingerland - First Grade Screening Test

    Visual Analysis of Picture Completion Skills

13. Slingerland - First Grade Screening Test

    Visual Analysis of Visual Memory Skills

14. Developmental Test of Visual Motor Integration

15. Slingerland - First Grade Screening Test

    Visual Analysis of Matching Skills

16. Slingerland - First Grade Screening Test

    Visual Analysis of Copying Skills

17. Developmental Test of Visual Perception

18. Slingerland - First Grade Screening Test

    Compilation of all Visual Tasks

19. Des Plaines Kindergarten Test

    Purdue Perceptional Motor Survey

    Perceptual Survey Rating Scale

20. Des Plaines Kindergarten Test

    Visual Discrimination Test

21. Des Plaines Kindergarten Test

    Visual Memory Test

22. Des Plaines Kindergarten Test

    Spatial Relationship Tasks

23. Des Plaines Kindergarten Test

    Figure Ground Task

24. Des Plaines Kindergarten Test

    Enclosure Ability

25. Des Plaines Kindergarten Test

    Gross Motor Tasks

26. Des Plaines Kindergarten Test

    Fine Motor Tasks

27. Slingerland - First Grade Screening Test

    Auditory Discrimination

28. Gates-McGintie Readiness Test

    Auditory Word Meaning Tasks

29. Gates-McGintie Readiness Test

    Auditory Listening Test

30. Gates-McGintie Readiness Test

    Auditory Sound Blending Test

31. Gates-McGintie Readiness Test

    Following Directions Tasks

32. Non Verbal Auditory Discrimination Tasks

33. Slingerland - First Grade Screening Tasks

    Tasks Analysis all Items

34. Illinois Tests of Psycholinguistic Abilities

    All Auditory Tasks

35. Illinois Tests of Psycholinguistic Abilities

    All Visual Tasks

36. Wepman Auditory Discrimination Tasks

APPENDIX B

Variance - Covariance Matrix of Thirty-Six Variables That are Task Analyzed to Determine Auditory, Visual and Random Learners

Standard Deviations

0.4515	14.2242	0.8172	16.6908	18.8407	0.3730	0.3842	0.4797
0.4436	0.4045	0.3947	0.3003	0.3662	0.0608	0.3168	0.3903
0.2901	0.2794	0.0608	0.3713	0.3146	0.2143	0.2363	0.2063
0.0430	0.2560	0.4406	0.4570	0.4483	0.4595	0.4355	0.3628
0.3680	0.4656	0.4626	0.4279				

Variance - Covariance Matrix

Row	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
1	0.2039	3.2418	0.0683	3.6085	4.0715	0.0397	0.0471	0.0579
2	3.2418	202.3266	0.2579	71.4707	90.4225	0.4527	0.5249	0.8468
3	0.0683	0.2579	0.6679	4.6938	4.9721	0.1336	0.0204	0.0983

4	3.6085	71.4707	4.6938	278.5818	250.0868	1.9912	1.5128	2.1444
5	4.0715	90.4225	4.9721	250.0868	354.9734	1.6134	1.4256	2.3978
6	0.0397	0.4527	0.1336	1.9912	1.6134	0.1391	0.0553	0.0720
7	0.0471	0.5249	0.0204	1.5128	1.4256	0.0553	0.1476	0.0785
8	0.0579	0.8468	0.0983	2.1444	2.3978	0.0720	0.0785	0.2301
9	0.0406	0.3603	0.0352	2.0447	2.3922	0.0516	0.0723	0.1209
10	0.0291	0.3485	0.0427	1.9881	2.4006	0.0362	0.0595	0.0841
11	0.0261	0.3393	0.1262	1.6503	1.9094	0.0532	0.0266	0.0887
12	0.0175	0.1592	0.1002	1.5190	1.4607	0.0371	0.0395	0.0384
13	0.0230	-0.2473	0.1595	1.4271	1.3934	0.0532	0.0307	0.0617
14	0.0003	0.0071	0.0037	-0.0148	0.0015	-0.0006	0.0012	0.0005
15	0.0244	0.4467	0.1132	1.6045	1.5754	0.0535	0.0335	0.0560
16	0.0247	0.4687	0.1800	2.2847	2.0667	0.0671	0.0405	0.0722
17	0.0145	0.2377	0.0928	1.2777	1.0831	0.0458	0.0297	0.0299
18	0.0197	0.3329	0.0705	1.2479	1.0894	0.0451	0.0273	0.0289
19	0.0005	-0.0077	0.0037	-0.0111	-0.0134	-0.0006	0.0012	0.0005
20	0.0269	0.4575	0.1076	1.6461	1.7963	0.0430	0.0223	0.0634
21	0.0241	0.3958	0.1113	1.2631	0.9828	0.0352	0.0245	0.0381

22	0.0128	0.0500	0.0482	1.1769	0.9763	0.0309	0.0303	0.0199
23	0.0177	0.2347	0.0575	1.5685	1.2887	0.0328	0.0283	0.0326
24	0.0151	0.1394	0.0445	1.2696	1.0138	0.0241	0.0273	0.0268
25	0.0012	0.0193	0.0019	0.1206	0.0879	0.0015	0.0015	0.0012
26	0.0082	0.2561	0.0557	1.3813	1.0946	0.0216	0.0226	0.0249
27	0.0484	0.2541	-0.0204	1.2561	1.6646	-0.0421	-0.0288	-0.0756
28	0.0501	0.4889	-0.0093	1.3568	2.2214	-0.0383	-0.0236	-0.0745
29	0.0425	0.4774	-0.0315	2.2155	2.9080	-0.0260	-0.0073	-0.0438
30	0.0283	0.1648	0.0186	1.7224	2.3443	-0.0374	-0.0395	-0.0877
31	0.0063	0.2613	0.0093	1.2449	1.9151	-0.0368	-0.0401	-0.0834
32	-0.0177	0.0751	0.0019	0.5663	1.1526	-0.0260	-0.0261	-0.0538
33	-0.0164	-0.0116	.0.0074	0.6647	1.1938	-0.0232	-0.0253	-0.0521
34	-0.0234	-0.3428	0.1503	-0.0101	0.7082	0.0028	-0.0421	-0.0280
35	0.0716	0.3868	0.1354	2.7652	2.5123	0.0281	0.0223	-0.0050
36	0.0391	0.1018	-0.0000	1.3282	1.6094	-0.0402	-0.0433	-0.0862

Row	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16
1	0.0406	0.0291	0.0261	0.0175	0.0230	0.0003	0.0244	0.0247
2	0.3603	0.3485	0.3393	0.1592	0.2473	0.0071	0.4467	0.4687
3	0.0352	0.0427	0.1262	0.1002	0.1595	0.0037	0.1132	0.1800
4	2.0447	1.9881	1.6503	1.5190	1.4271	-0.0148	1.6045	2.2847
5	2.3922	2.4006	1.9094	1.4607	1.3934	0.0015	1.5754	2.0667
6	0.0516	0.0362	0.0532	0.0371	0.0532	-0.0006	0.0535	0.0671
7	0.0723	0.0595	0.0266	0.0395	0.0307	0.0012	0.0335	0.0405
8	0.1209	0.0841	0.0887	0.0384	0.0617	0.0005	0.0560	0.0722
9	0.1968	0.1395	0.0614	0.0417	0.0462	0.0027	0.0327	0.0499
10	0.1395	0.1636	0.0679	0.0425	0.0414	0.0011	0.0324	0.0450
11	0.0614	0.0679	0.1558	0.0419	0.0657	0.0011	0.0524	0.0493
12	0.0417	0.0425	0.0419	0.0902	0.0397	0.0033	0.0499	0.0536
13	0.0462	0.0414	0.0657	0.0397	0.1341	-0.0006	0.0506	0.0611
14	0.0027	0.0011	0.0011	0.0033	-0.0006	0.0037	0.0014	-0.0007
15	0.0327	0.0324	0.0524	0.0499	0.0506	0.0014	0.1004	0.0753
16	0.0499	0.0450	0.0493	0.0536	0.0611	-0.0007	0.0753	0.1523

17	0.0419	0.0477	0.0489	0.0352	0.0502	-0.0003	0.0378	0.0513
18	0.0346	0.0307	0.0411	0.0230	0.0346	-0.0003	0.0293	0.0304
19	0.0009	0.0011	0.0011	0.0015	0.0013	0.0018	0.0014	-0.0007
20	0.0540	0.0514	0.0628	0.0354	0.0757	0.0031	0.0481	0.0378
21	0.0258	0.0328	0.0435	0.0278	0.0676	-0.0004	0.0357	0.0423
22	0.0242	0.0272	0.0297	0.0323	0.0294	-0.0002	0.0317	0.0299
23	0.0175	0.0212	0.0331	0.0293	0.0332	-0.0002	0.0397	0.0334
24	0.0233	0.0242	0.0267	0.0271	0.0244	-0.0002	0.0339	0.0288
25	0.0014	0.0015	0.0015	0.0017	0.0016	-0.0000	0.0016	0.0015
26	0.0145	0.0152	0.0105	0.0245	0.0203	-0.0003	0.0236	0.0350
27	-0.0522	-0.0430	-0.0489	-0.0245	-0.0401	-0.0010	-0.0279	-0.0456
28	-0.0574	-0.0480	-0.0535	-0.0204	-0.0436	-0.0011	-0.0243	-0.0425
29	-0.0191	-0.0164	-0.0350	-0.0204	-0.0332	-0.0010	-0.0203	-0.0391
30	-0.0664	-0.0492	-0.0471	-0.0154	-0.0370	-0.0011	-0.0193	-0.0417
31	-0.0627	-0.0467	-0.0452	-0.0217	-0.0368	-0.0009	-0.0213	-0.0401
32	-0.0418	-0.0320	-0.0282	-0.0156	-0.0230	-0.0006	-0.0157	-0.0273
33	-0.0415	-0.0332	-0.0274	-0.0106	-0.0201	-0.0006	-0.0108	-0.0246
34	-0.0258	-0.0170	0.0447	-0.0020	0.0367	0.0007	0.0031	-0.0074

35	-0.0053	0.0050	-0.0114	0.0302	0.0193	0.0007	0.0262	0.0459
36	-0.0648	-0.0496	-0.0464	-0.0241	-0.0384	-0.0009	-0.0272	-0.0451

Row	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21	Col. 22	Col. 23	Col. 24
1	0.0145	0.0197	0.0005	0.0269	0.0241	0.0128	0.0177	0.0151
2	0.2377	0.3329	-0.0077	0.4575	0.3958	0.0500	0.2347	0.1394
3	0.0928	0.0705	0.0037	0.1076	0.1113	0.0482	0.0575	0.0445
4	1.2777	1.2479	-0.0111	1.6461	1.2631	1.1769	1.5685	1.2696
5	1.0831	1.0894	-0.0134	1.7963	0.9828	0.9763	1.2887	1.0138
6	0.0458	0.0451	-0.0006	0.0430	0.0352	0.0309	0.0328	0.0241
7	0.0297	0.0273	0.0012	0.0223	0.0245	0.0303	0.0283	0.0273
8	0.0299	0.0289	0.0005	0.0634	0.0381	0.0199	0.0326	0.0268
9	0.0419	0.0346	0.0009	0.0540	0.0258	0.0242	0.0175	0.0233
10	0.0477	0.0307	0.0011	0.0514	0.0328	0.0272	0.0212	0.0242
11	0.0489	0.0411	0.0011	0.0628	0.0435	0.0297	0.0331	0.0267
12	0.0352	0.0230	0.0015	0.0354	0.0278	0.0323	0.0293	0.0271
13	0.0502	0.0346	0.0013	0.0757	0.0676	0.0294	0.0332	0.0244

14	-0.0003	-0.0003	0.0018	0.0031	-0.0004	-0.0002	-0.0002	-0.0002
15	0.0378	0.0293	0.0014	0.0481	0.0357	0.0317	0.0397	0.0339
16	0.0513	0.0304	-0.0007	0.0378	0.0423	0.0299	0.0334	0.0288
17	0.0842	0.0515	-0.0003	0.0329	0.0398	0.0308	0.0242	0.0237
18	0.0515	0.0781	-0.0003	0.0268	0.0332	0.0274	0.0246	0.0259
19	-0.0003	-0.0003	0.0037	0.0031	-0.0004	-0.0002	-0.0002	-0.0002
20	0.0329	0.0268	0.0031	0.1379	0.0484	0.0310	0.0329	0.0261
21	0.0398	0.0332	-0.0004	0.0484	0.0989	0.0262	0.0305	0.0247
22	0.0308	0.0274	-0.0002	0.0310	0.0262	0.0459	0.0287	0.0294
23	0.0242	0.0246	-0.0002	0.0329	0.0305	0.0287	0.0558	0.0326
24	0.0237	0.0259	-0.0002	0.0261	0.0247	0.0294	0.0326	0.0425
25	0.0017	0.0017	-0.0000	0.0015	0.0016	0.0018	0.0017	0.0018
26	0.0139	0.0107	-0.0003	0.0162	0.0126	0.0207	0.0255	0.0228
27	-0.0225	-0.0206	-0.0010	-0.0379	-0.0274	-0.0108	-0.0119	-0.0099
28	-0.0219	-0.0197	-0.0011	-0.0396	-0.0256	-0.0069	-0.0083	-0.0076
29	-0.0202	-0.0144	-0.0010	-0.0273	-0.0198	-0.0078	-0.0035	-0.0049
30	-0.0206	-0.0183	-0.0011	-0.0369	-0.0243	-0.0071	-0.0012	-0.0005
31	-0.0198	-0.0179	-0.0009	-0.0326	-0.0227	-0.0085	-0.0039	-0.0057

32	-0.0126	-0.0114	-0.0006	-0.0238	-0.0155	-0.0056	-0.0074	-0.0051
33	-0.0131	-0.0119	-0.0006	-0.0210	-0.0142	-0.0059	-0.0021	-0.0035
34	0.0207	0.0119	0.0007	0.0238	0.0297	-0.0004	-0.0040	-0.0085
35	0.0140	0.0089	0.0007	0.0064	0.0120	0.0185	0.0225	0.0215
36	-0.0223	-0.0205	-0.0009	-0.0379	-0.0268	-0.0116	-0.0124	-0.0107

Row	Col. 25	Col. 26	Col. 27	Col. 28	Col. 29	Col. 30	Col. 31	Col. 32
1	0.0012	0.0082	0.0484	0.0501	0.0425	0.0283	0.0063	-0.0177
2	0.0193	0.2561	0.2541	0.4889	0.4774	0.1648	0.2613	0.0751
3	0.0019	0.0557	-0.0204	-0.0093	-0.0315	0.0186	0.0093	0.0019
4	0.1206	1.3813	1.2561	1.3568	2.2155	1.7224	1.2449	0.5663
5	0.0879	1.0946	1.6646	2.2214	2.9080	2.3443	1.9151	1.1526
6	0.0015	0.0216	-0.0421	-0.0383	-0.0260	-0.0374	-0.0368	-0.0260
7	0.0015	0.0226	-0.0288	-0.0236	-0.0073	-0.0395	-0.0401	-0.0261
8	0.0012	0.0249	-0.0756	-0.0745	-0.0438	-0.0877	-0.0834	-0.0538
9	0.0014	0.0145	-0.0522	-0.0574	-0.0191	-0.0664	-0.0627	-0.0418
10	0.0015	0.0152	-0.0430	-0.0480	-0.0164	-0.0492	-0.0467	-0.0320

11	0.0015	0.0105	-0.0489	-0.0535	-0.0350	-0.0471	-0.0452	-0.0282
12	0.0017	0.0245	-0.0245	-0.0204	-0.0204	-0.0154	-0.0217	-0.0156
13	0.0016	0.0203	-0.0401	-0.0436	-0.0332	-0.0370	-0.0368	-0.0230
14	-0.0000	-0.0003	-0.0010	-0.0011	-0.0010	-0.0011	-0.0009	-0.0006
15	0.0016	0.0236	-0.0279	-0.0243	-0.0203	-0.0193	-0.0213	-0.0157
16	0.0015	0.0350	-0.0456	-0.0425	-0.0391	-0.0417	-0.0401	-0.0273
17	0.0017	0.0139	-0.0225	-0.0219	-0.0202	-0.0206	-0.0198	-0.0126
18	0.0017	0.0107	-0.0206	-0.0197	-0.0144	-0.0183	-0.0179	-0.0114
19	-0.0000	-0.0003	-0.0010	-0.0011	-0.0010	-0.0011	-0.0009	-0.0006
20	0.0015	0.0162	-0.0379	-0.0396	-0.0273	-0.0369	-0.0326	-0.0238
21	0.0016	0.0126	-0.0274	-0.0256	-0.0198	-0.0243	-0.0227	-0.0155
22	0.0018	0.0207	-0.0108	-0.0069	-0.0078	-0.0071	-0.0085	-0.0056
23	0.0017	0.0255	-0.0119	-0.0083	-0.0035	-0.0012	-0.0039	-0.0074
24	0.0018	0.0228	-0.0099	-0.0076	-0.0049	-0.0005	-0.0057	-0.0051
25	0.0019	-0.0001	-0.0005	-0.0005	-0.0005	0.0013	-0.0005	-0.0003
26	-0.0001	0.0655	-0.0111	-0.0153	-0.0047	0.0010	-0.0012	0.0020
27	-0.0005	-0.0111	0.1942	0.1483	0.0919	0.1246	0.0853	0.0240
28	-0.0005	-0.0153	0.1483	0.2089	0.1105	0.1386	0.1065	0.0466

29	-0.0005	-0.0047	0.0919	0.1105	0.2010	0.1034	0.1075	0.0550
30	0.0013	0.0010	0.1246	0.1386	0.1034	0.2111	0.1366	0.0884
31	-0.0005	-0.0012	0.0853	0.1065	0.1075	0.1366	0.1897	0.1126
32	-0.0003	0.0020	0.0240	0.0466	0.0550	0.0884	0.1126	0.1316
33	-0.0003	0.0053	0.0243	0.0468	0.0553	0.0904	0.1112	0.1289
34	-0.00-6	-0.0112	-0.0037	0.0136	0.0232	0.0508	0.0753	0.1009
35	0.0013	0.0264	0.0799	0.0715	0.0345	0.0549	0.0253	-0.0371
36	-0.0004	-0.0114	0.1499	0.1345	0.0981	0.1239	0.1039	0.0385

	Col. 33	Col. 34	Col. 35	Col. 36
1	-0.0164	-0.0234	0.0716	0.0391
2	-0.0116	-0.3428	0.3868	0.1018
3	0.0074	0.1503	0.1354	-0.0000
4	0.6647	-0.0101	2.7652	1.3282
5	1.1938	0.7082	2.5123	1.6094
6	-0.0232	0.0028	0.0281	-0.0402
7	-0.0253	-0.0421	0.0223	-0.0433
8	-0.0521	-0.0280	-0.0050	-0.0862

9	-0.0415	-0.0258	-0.0053	-0.0648
10	-0.0332	-0.0170	0.0050	-0.0496
11	-0.0274	0.0447	-0.0114	-0.0464
12	-0.0106	-0.0020	0.0302	-0.0241
13	-0.0201	0.0367	0.0193	-0.0384
14	-0.0006	0.0007	0.0007	-0.0009
15	-0.0108	0.0031	0.0262	-0.0272
16	-0.0246	-0.0074	0.0459	-0.0451
17	-0.0131	0.0207	0.0140	-0.0223
18	-0.0119	0.0119	0.0089	-0.0205
19	-0.0006	0.0007	0.0007	-0.0009
20	-0.0210	0.0238	0.0064	-0.0379
21	-0.0142	0.0297	0.0120	-0.0268
22	-0.0059	-0.0004	0.0185	-0.0116
23	-0.0021	-0.0040	0.0225	-0.0124
24	-0.0035	-0.0085	0.0215	-0.0107
25	-0.0003	-0.0006	0.0013	-0.0004
26	0.0053	-0.0112	0.0264	-0.0114

27	0.0243	-0.0037	0.0799	0.1499
28	0.0468	0.0136	0.0715	0.1345
29	0.0553	0.0232	0.0345	0.0981
30	0.0904	0.0508	0.0549	0.1239
31	0.1112	0.0753	0.0253	0.1039
32	0.1289	0.1009	-0.0371	0.0385
33	0.1354	0.1010	-0.0351	0.0353
34	0.1010	0.2168	0.2140	0.0868
35	-0.0351	-0.0888	0.0868	0.1831
36	0.0353	0.0053		

APPENDIX C

Correlational Matrix of Thirty-Six Variables That are Task Analyzed to Determine Auditory, Visual and Random Learners

The variables that were controled and coded are as follows:

1. Metropolitan Achievement
   Test-Reading Subtest
2. Intelligence Test - Lorge-Thorndike Intelligence Text
   Primary Battery Level I
3. Modality through which the subject shows strength. By this the dissertation has signified that the learner is:
   A. An auditory learner - successfully completing ninety per cent of all auditory tasks.
   B. A visual learner - successfully completing ninety per cent of all visual tasks.
   C. A random learner - successfully completing ninety per cent of all auditory and visual tasks.
4. Metropolitan Readiness Test - This score was recorded in percentile figures.
5. Gates-McGintie Test - This score was recorded in percentile figures.
6. Slingerland - First Grade Screening Test
   Visual Discrimination of Letter Forms
7. Slingerland - First Grade Screening Test
   Visual Knowledge of the Alphabet

8. University of California at Los Angeles
   Visual Discrimination Inventory
9. Slingerland - First Grade-Screening Test
   Analysis of Visual Reversals
10. Slingerland - First Grade Screening Test
    Visual Analysis of Inversions
11. Slingerland - First Grade Screening Test
    Visual Analysis of Whole Word Attack Skills
12. Slingerland - First Grade Screening Test
    Visual Analysis of Picture Completion Skills
13. Slingerland - First Grade Screening Test
    Visual Analysis of Visual Memory Skills
14. Developmental Test of Visual Motor Integration
15. Slingerland - First Grade Screening Test
    Visual Analysis of Matching Skills
16. Slingerland - First Grade Screening Test
    Visual Analysis of Copying Skills
17. Developmental Test of Visual Perception
18. Slingerland - First Grade Screening Test
    Compilation of all Visual Tasks
19. Des Plaines Kindergarten Test
    Purdue Perceptional Motor Survey
    Perceptual Survey Rating Scale

20. Des Plaines Kindergarten Test
    Visual Discrimination Test
21. Des Plaines Kindergarten Test
    Visual Memory Test
22. Des Plaines Kindergarten Test
    Spatial Relationship Tasks
23. Des Plaines Kindergarten Test
    Figure Ground Task
24. Des Plaines Kindergarten Test
    Enclosure Ability
25. Des Plaines Kindergarten Test
    Gross Motor Tasks
26. Des Plaines Kindergarten Test
    Fine Motor Tasks
27. Slingerland - First Grade Screening Test
28. Gates-McGintie Readiness Test
    Auditory Word Meaning Tasks
29. Gates-McGintie Readiness Test
    Auditory Listening Test
30. Gates-McGintie Readiness Test
    Auditory Sound Blending Test
31. Gates-McGintie Readiness Test
    Following Directions Tasks

32. Non Verbal Auditory Discrimination Tasks

33. Slingerland - First Grade Screening Tasks

    Tasks Analysis all Items

34. Illinois Tests of Psycholinguistic Abilities

    All Auditory Tasks

35. Illinois Tests of Psycholinguistic Abilities

    All Visual Tasks

36. Wepman Auditory Discrimination Tasks

APPENDIX C

Correlational Matrix of Thirty-Six Variables That are Task Analyzed to Determine Auditory, Visual and Random Learners

Correlation Matrix

Row	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8
1	1.0000	0.5047	0.1850	0.4788	0.4786	0.2359	0.2717	0.2671
2	0.5047	1.0000	0.0222	0.3010	0.3374	0.0853	0.0961	0.1241
3	0.1850	0.0222	1.0000	0.3441	0.3229	0.4382	0.0650	0.2508
4	0.4788	0.3010	0.3441	1.0000	0.7953	0.3198	0.3259	0.2678

5	0.4786	0.3374	0.3229	0.7953	1.0000	0.2296	0.1969	0.2653
6	0.2359	0.0853	0.4382	0.3198	0.2296	1.0000	0.3862	0.4026
7	0.2717	0.0961	0.0650	0.2359	0.1969	0.3862	1.0000	0.4261
8	0.2671	0.1241	0.2508	0.2678	0.2653	0.4026	0.4261	1.0000
9	0.2028	0.0571	0.0972	0.2762	0.2862	0.3124	0.4240	0.5683
10	0.1593	0.0606	0.1291	0.2945	0.3150	0.2398	0.3827	0.4334
11	0.1467	0.0604	0.3911	0.2505	0.2568	0.3612	0.1752	0.4687
12	0.1293	0.0373	0.4083	0.3031	0.2582	0.3313	0.3425	0.2666
13	0.1392	0.0475	0.5331	0.2335	0.2019	0.3893	0.2182	0.3512
14	0.0104	0.0082	0.0747	-0.0146	0.0013	-0.0273	0.0509	0.0181
15	0.1704	0.0991	0.4371	0.3034	0.2639	0.4526	0.2750	0.3686
16	0.1402	0.0844	0.5642	0.3507	0.2811	0.4609	0.2704	0.3855
17	0.1111	0.0576	0.3912	0.2639	0.1981	0.4229	0.2666	0.2150
18	0.1564	0.0838	0.3087	0.2676	0.2069	0.4332	0.2547	0.2154
19	0.0171	-0.0089	0.0747	-0.0109	-0.0117	-0.0273	0.0509	0.0181
20	0.1603	0.0866	0.3546	0.2656	0.2567	0.3103	0.1562	0.3561
21	0.1699	0.0885	0.4330	0.2406	0.1658	0.3004	0.2030	0.2528
22	0.1323	0.0164	0.2754	0.3291	0.2419	0.3869	0.3680	0.1933

23	0.1662	0.0698	0.2978	0.3977	0.2895	0.3718	0.3116	0.2875
24	0.1623	0.0475	0.2641	0.3688	0.2609	0.3135	0.3439	0.2704
25	0.0599	0.0316	0.0527	0.1679	0.1084	0.0963	0.0921	0.0578
26	0.0710	0.0703	0.2660	0.3233	0.2270	0.2267	0.2296	0.2027
27	0.2435	0.0405	-0.0567	0.1708	0.2005	-0.2558	-0.1699	-0.3577
28	0.2427	0.0752	-0.0248	0.1779	0.2580	-0.2249	-0.1346	-0.3401
29	0.2101	0.0749	-0.0861	0.2961	0.3443	-0.1553	-0.0425	-0.2037
30	0.1366	0.0252	0.0494	0.2246	0.2708	-0.2183	-0.2236	-0.3978
31	0.0319	0.0422	0.0261	0.1713	0.2334	-0.2265	-0.2396	-0.3993
32	-0.1081	0.0145	0.0063	0.0935	0.1686	-0.1919	-0.1875	-0.3094
33	-0.0989	-0.0022	0.0247	0.1082	0.1722	-0.1690	-0.1788	-0.2953
34	-0.1113	-0.0518	0.3949	-0.0013	0.0807	0.0160	-0.2356	-0.1256
35	0.3427	0.0588	0.3582	0.3581	0.2882	0.1630	0.1253	-0.0225
36	0.2025	0.0167	-0.0000	0.1860	0.1996	-0.2518	-0.2635	-0.4199

Row	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14	Col. 15	Col. 16
1	0.2028	0.1593	0.1467	0.1293	0.1392	0.0104	0.1704	0.1402

2	0.0571	0.0606	0.0604	0.0373	0.0475	0.0082	0.0991	0.0844
3	0.0972	0.1291	0.3911	0.4083	0.5331	0.0747	0.4371	0.5642
4	0.2762	0.2945	0.2505	0.3031	0.2335	-0.0146	0.3034	0.3507
5	0.2862	0.3150	0.2568	0.2582	0.2019	0.0013	0.2639	0.2811
6	0.3121	0.2398	0.3612	0.3313	0.3893	-0.0273	0.4526	0.4609
7	0.4240	0.3827	0.1752	0.3425	0.2182	0.0509	0.2750	0.2704
8	0.5683	0.4334	0.4687	0.2666	0.3512	0.0181	0.3686	0.3855
9	1.0000	0.7775	0.3504	0.3134	0.2844	0.1006	0.2326	0.2880
10	0.7775	1.0000	0.4256	0.3496	0.2796	0.0444	0.2528	0.2849
11	0.3504	0.4256	1.0000	0.3538	0.4548	0.0475	0.4191	0.3197
12	0.3134	0.3498	0.3538	1.0000	0.3610	0.1829	0.5246	0.4575
13	0.2844	0.2796	0.4548	0.3610	1.0000	-0.0265	0.4362	0.4272
14	0.1006	0.0444	0.0475	0.1829	-0.0265	1.0000	0.0746	-0.0292
15	0.2326	0.2528	0.4191	0.5246	0.4362	0.0746	1.0000	0.6090
16	0.2880	0.2849	0.3197	0.4575	0.4272	-0.0292	0.6090	1.0000
17	0.3254	0.4067	0.4272	0.4046	0.4721	-0.0195	0.4108	0.4530
18	0.2791	0.2716	0.3725	0.2742	0.3386	-0.0186	0.3312	0.2789
19	0.0318	0.0444	0.0475	0.0813	0.0568	0.4981	0.0746	-0.0292

20	0.3277	0.3422	0.4286	0.3178	0.5569	0.1373	0.4091	0.2605
21	0.1847	0.2576	0.3503	0.2946	0.5869	-0.0216	0.3578	0.3442
22	0.2541	0.3137	0.3508	0.5017	0.3749	-0.0137	0.4663	0.3580
23	0.1665	0.2217	0.3548	0.4131	0.3838	-0.0153	0.5298	0.3624
24	0.2546	0.2906	0.3277	0.4374	0.3236	-0.0132	0.5192	0.3575
25	0.0711	0.0847	0.0882	0.1292	0.0990	-0.0026	0.1207	0.0898
26	0.1274	0.1467	0.1043	0.3186	0.2166	-0.0168	0.2907	0.3508
27	-0.2670	-0.2414	-0.2811	-0.1851	-0.2485	-0.0364	-0.1999	-0.2649
28	-0.2833	-0.2598	-0.2963	-0.1487	-0.2603	-0.0396	-0.1675	-0.2384
29	-0.0959	-0.0904	-0.1980	-0.1516	-0.2021	-0.0378	-0.1430	-0.2232
30	-0.3256	-0.2646	-0.2598	-0.1116	-0.2200	-0.0401	-0.1327	-0.2326
31	-0.3244	-0.2650	-0.2632	-0.1660	-0.2305	-0.0355	-0.1543	-0.2360
32	-0.2600	-0.2183	-0.1967	-0.1431	-0.1728	-0.0262	-0.1370	-0.1928
33	-0.2541	-0.2229	-0.1885	-0.0957	-0.1494	-0.0267	-0.0927	-0.1714
34	-0.1250	-0.0901	0.2430	-0.0146	0.2151	0.0240	0.0212	-0.0406
35	-0.0257	0.0265	-0.0626	0.2177	0.1139	0.0252	0.1789	0.2544
36	-0.3412	-0.2864	-0.2750	-0.1877	-0.2451	-0.0343	-0.2010	-0.2701

Row	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21	Col. 22	Col. 23	Col. 24
1	0.111	0.1564	0.0171	0.1603	0.1699	0.1323	0.1662	0.1623
2	0.0576	0.0838	-0.0089	0.0866	0.0885	0.0164	0.0698	0.0475
3	0.3912	0.3087	0.0747	0.3546	0.4330	0.2754	0.2978	0.2641
4	0.2639	0.2676	-0.0109	0.2656	0.2406	0.3291	0.3977	0.3688
5	0.1981	0.2069	-0.0117	0.2567	0.1658	0.2419	0.2895	0.2609
6	0.4229	0.4332	-0.0273	0.3103	0.3004	0.3869	0.3718	0.3135
7	0.2666	0.2547	0.0509	0.1562	0.2030	0.3680	0.3116	0.3439
8	0.2150	0.2154	0.0181	0.3561	0.2528	0.1933	0.2875	0.2704
9	0.3254	0.2791	0.0318	0.3277	0.1847	0.2541	0.1665	0.2546
10	0.4067	0.2716	0.0444	0.3422	0.2576	0.3137	0.2217	0.2906
11	0.4272	0.3725	0.0475	0.4286	0.3503	0.3508	0.3548	0.3277
12	0.4046	0.2742	0.0813	0.3178	0.2946	0.5017	0.4131	0.4374
13	0.4721	0.3386	0.0568	0.5569	0.5869	0.3749	0.3838	0.3236
14	-0.0195	-0.0186	0.4981	0.1373	-0.0216	-0.0137	-0.0153	-0.0132
15	0.4108	0.3312	0.0746	0.4091	0.3578	0.4663	0.5298	0.5192
16	0.4530	0.2789	-0.0292	0.2605	0.3442	0.3580	0.3624	0.3575

17	1.0000	0.6349	-0.0195	0.3058	0.4360	0.4952	0.3528	0.3962
18	0.6349	1.0000	-0.0186	0.2578	0.3776	0.4582	0.3730	0.4493
19	-0.0195	-0.0186	1.0000	0.1373	-0.0216	-0.0137	-0.0153	-0.0132
20	0.3058	0.2578	0.1373	1.0000	0.4147	0.3897	0.3747	0.3402
21	0.4360	0.3776	-0.0216	0.4147	1.0000	0.3884	0.4104	0.3813
22	0.4952	0.4582	-0.0137	0.3897	0.3884	1.0000	0.5664	0.6651
23	0.3528	0.3730	-0.0153	0.3747	0.4104	0.5664	1.0000	0.6691
24	0.3962	0.4493	-0.0132	0.3402	0.3813	0.6651	0.6691	1.0000
25	0.1343	0.1412	-0.0026	0.0970	0.1218	0.1915	0.1716	0.1997
26	0.1869	0.1495	-0.0168	0.1705	0.1562	0.3778	0.4216	0.4326
27	-0.1763	-0.1672	-0.0364	-0.2313	-0.1978	-0.1147	-0.1143	-0.1084
28	-0.1653	-0.1544	-0.0396	-0.2336	-0.1778	-0.0702	-0.0770	-0.0809
29	-0.1553	-0.1152	-0.0378	-0.1641	-0.1403	-0.0815	-0.0331	-0.0535
30	-0.1544	-0.1429	-0.0401	-0.2160	-0.1683	-0.0725	-0.0113	-0.0048
31	-0.1569	-0.1474	-0.0355	-0.2017	-0.1655	-0.0914	-0.0382	-0.0638
32	-0.1195	-0.1127	-0.0262	-0.1769	-0.1355	-0.0727	-0.0861	-0.0678
33	-0.1221	-0.1157	-0.0267	-0.1540	-0.1229	-0.0750	-0.0247	-0.0456
34	0.1[illegible]	0.0918	0.0240	0.1375	0.2027	-0.0043	-0.0360	-0.0889

35	0.1042	0.0685	0.0252	0.0375	0.0821	0.1864	0.2054	0.2251
36	-0.1799	-0.1718	-0.0343	-0.2385	-0.1991	-0.1266	-0.1230	-0.1214

Row	Col. 25	Col. 26	Col. 27	Col. 28	Col. 29	Col. 30	Col. 31	Col. 32
1	0.0599	0.0710	0.2435	0.2427	0.2101	0.1366	0.0319	-0.1081
2	0.0316	0.0703	0.0405	0.0752	0.0749	0.0252	0.0422	0.0145
3	0.0527	0.2660	-0.0567	-0.0248	-0.0861	0.0494	0.0261	0.0063
4	0.1679	0.3233	0.1708	0.1779	0.2961	0.2246	0.1713	0.0935
5	0.1084	0.2270	0.2005	0.2580	0.3443	0.2708	0.2334	0.1685
6	0.0963	0.2267	-0.2558	-0.2249	-0.1553	-0.2183	-0.2265	-0.1919
7	0.0921	0.2296	-0.1699	-0.1346	-0.0425	-0.2236	-0.2396	-0.1875
8	0.0578	0.2027	-0.3577	-0.3401	-0.2037	-0.3978	-0.3993	-0.3094
9	0.0711	0.1274	-0.2670	-0.2833	-0.0959	-0.3256	-0.3244	-0.2600
10	0.0847	0.1467	-0.2414	-0.2598	-0.0904	-0.2646	-0.2650	-0.2183
11	0.0882	0.1043	-0.2811	-0.2963	-0.1980	-0.2598	-0.2632	-0.1967
12	0.1292	0.3186	-0.1851	-0.1487	-0.1516	-0.1116	-0.1660	-0.1431
13	0.0990	0.2166	-0.2485	-0.2603	-0.2021	-0.2200	-0.2305	-0.1728

13	0.0990	0.2166	-0.2485	-0.2603	-0.2021	-0.2200	-0.2305	-0.1728
14	-0.0026	-0.0168	-0.0364	-0.0396	-0.0378	-0.0401	-0.0355	-0.0262
15	0.1207	0.2907	-0.1999	-0.1675	-0.1430	-0.1327	-0.1543	-0.1370
16	0.0898	0.3508	-0.2649	-0.2384	-0.2232	-0.2326	-0.2360	-0.1928
17	0.1348	0.1869	-0.1763	-0.1653	-0.1553	-0.1544	-0.1569	-0.1195
18	0.1412	0.1495	-0.1672	-0.1544	-0.1152	-0.1429	-0.1474	-0.1127
19	-0.0026	-0.0168	-0.0364	-0.0396	-0.0378	-0.0401	-0.0355	-0.0262
20	0.0970	0.1705	-0.2313	-0.2336	-0.1641	-0.2160	-0.2017	-0.1769
21	0.1218	0.1562	-0.1978	-0.1778	-0.1403	-0.1683	-0.1655	-0.1355
22	0.1915	0.3778	-0.1147	-0.0702	-0.0815	-0.0725	-0.0914	-0.0727
23	0.1716	0.4216	-0.1143	-0.0770	-0.0331	-0.0113	-0.0382	-0.0861
24	0.1997	0.4326	-0.1084	-0.0809	-0.0535	-0.0048	-0.0638	-0.0678
25	1.0000	-0.0118	-0.0257	-0.0279	-0.0267	0.0655	-0.0251	-0.0185
26	-0.0118	1.0000	-0.0986	-0.1310	-0.0413	0.0084	-0.0107	0.0218
27	-0.0257	-0.0986	1.0000	0.7363	0.4654	0.6152	0.4444	0.1498
28	-0.0279	-0.1310	0.7363	1.0000	0.5392	0.6600	0.5350	0.2810
29	-0.0267	-0.0413	0.4654	0.5392	1.0000	0.5018	0.5506	0.3384
30	0.0655	0.0084	0.6152	0.6600	0.5018	1.0000	0.6828	0.5303

31	-0.0251	-0.0107	0.4444	0.5350	0.5506	0.6828	1.0000	0.7126
32	-0.0185	0.0218	0.1498	0.2810	0.3384	0.5303	0.7126	1.0000
33	-0.0189	0.0567	0.1501	0.2782	0.3355	0.5348	0.6937	0.9655
34	-0.0293	-0.0939	-0.0178	0.0639	0.1111	0.2374	0.3716	0.5975
35	0.0644	0.2232	0.3921	0.3380	0.1665	0.2583	0.1255	-0.2208
36	-0.0243	-0.1041	0.7951	0.6875	0.5115	0.6299	0.5576	0.2483

	Col. 33	Col. 34	Col. 35	Col. 36	Col. 37	Col. 38	Col. 39	Col. 40
1	-0.0989	-0.1113	0.3427	0.2025				
2	-0.0022	-0.0518	0.0588	0.0167				
3	0.0247	0.3949	0.3582	-0.0000				
4	0.1082	-0.0013	0.3581	0.1860				
5	0.1722	0.0807	0.2882	0.1996				
6	-0.1690	0.0160	0.1630	-0.2518				
7	-0.1788	-0.2356	0.1253	-0.2635				
8	-0.2953	-0.1256	-0.0225	-0.4199				
9	-0.2541	-0.1250	-0.0257	-0.3412				
10	-0.2229	-0.0901	0.0265	-0.2864				

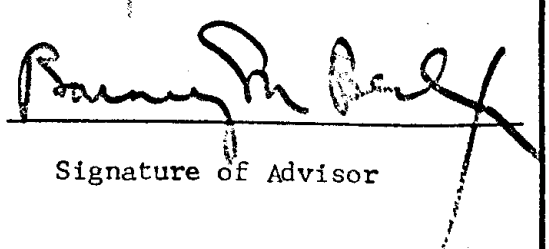
The dissertation submitted by Paul William Cates has been read and approved by members of the faculty of the School of Education.

The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

5-18-72

Date



Signature of Advisor